



TEXAS TECH UNIVERSITY
HEALTH SCIENCES CENTER™
at El Paso

DEPARTMENT OF RADIOLOGY



***DIAGNOSTIC RADIOLOGY
RESIDENCY PROGRAM MANUAL
INCLUDING GOALS AND OBJECTIVES
FOR 2008-2009***

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LETTER FROM THE CHAIRMAN AND PROGRAM DIRECTOR

Welcome to Radiology!

On behalf of the faculty, I would like to welcome you to the Department of Radiology and the newly established Texas Tech University HSC-El Paso Residency Program in Diagnostic Radiology. Texas Tech has a distinguished history in residency training and the beginning of a radiology training program is a most welcomed addition. The training program is divided into specialty radiology sections of Abdominal Imaging, Angiography and Interventional Radiology, Chest Radiology, Diagnostic Ultrasound, Emergency Radiology, Magnetic Resonance Imaging, Mammography, Musculoskeletal Radiology, Neuroradiology, Nuclear Radiology, Pediatric Radiology, and Radiation Physics. The residents will rotate into each sub-specialty area and work closely with faculty members who have established expertise in these disciplines.

Thomason Hospital is the primary teaching hospital and is also a Level I trauma center. Residents within the radiology residency training program are able to gain experience working with patients who have both simple and complex medical problems. The department enjoys a warm and collegial relationship with other training programs within the hospital. Radiology residents are anticipated to interact regularly with residents from other residency programs. The technology base of the department is "state of the art" with the latest CT, MR, and information systems technology. The department has operated in a filmless and paperless environment since 2005.

The training program is designed to enable residents to acquire and demonstrate the knowledge, skills, and judgment necessary for competence in the practice of Radiology. This is primarily achieved by involvement in clinical case management under direct supervision and guidance of the faculty. Formal teaching supplements this educational process by providing lectures, demonstrations and conferences as well as electronic teaching aids.

Competency in radiology consists of the ability to plan appropriate and most cost effective imaging sequences, obtaining these studies with utmost concern for patient care, and transferring necessary information to the referring clinician in a timely manner. Residents are to not only learn interpretation skills in evaluating radiological images but obtain competency in transferring this information in an efficient and effective manner. This is based on having the resident obtain background knowledge of the patient which may modify radiographic appearance or examination requests. The core knowledge, with which the resident radiologist must become familiar (and which will require continuing study for the rest of one's professional life) concerns the variety of pathologic findings that may be detected on images due to disease and the differentiation of these from normal, normal variations and technical artifacts. The resident must also learn to work closely with support personnel on patient care and administrative matters in order to assume competent and responsive consultative services and quality patient care.

The orientation program, for new residents, consists of early rotations through the basic services of chest, musculoskeletal, pediatric, and abdominal radiology. Orientation also includes a series of special teaching sessions on common radiology practices and procedures. Further instruction is presented during regularly scheduled departmental conferences. Residents are to be concerned and involved with quality assurance and other non-imaging issues involving total patient management during the radiologic process and are required to participate in a monthly quality assurance conference.

This manual describes the clinical, educational, and research opportunities for residents at Texas Tech University HSC-El Paso during the 2008 academic year. It can be anticipated that your training experience will prepare you to become a most competent clinical practitioner and/or academician with outstanding credentials. Your learning experience begins on the first day of your residency and continues through every day of each rotation. You need to stay focused and work hard throughout your residency so that you can be a successful addition to the practice of Radiology in Southwestern US or wherever you choose to go.

Welcome to the Radiology Residency Program for 2008-2009.

Arvin E. Robinson, M. D., MPH
Professor and Chairman of Radiology
Radiology Residency Program Director

FACULTY

Chair and Program Director

Robinson, Arvin E., M. D., MPH

Faculty (arrange alphabetically)

Noemi Brunner MD	Chest Radiology
Jesus Calleros MD (on leave)	Imaging and Interventional Radiology
Michel Courtines, M. D.	Nuclear Medicine
Jose Gavito, M. D.	Neuroradiology
Melhem Ghaleb MD	Vascular and Interventional Radiology
Hugo Isuani MD	Musculoskeletal Radiology
Sanja Kupescic MD, PhD	Obstetric and Gynecological Ultrasound
Llewelyn Lee, M. D.	Vascular and Interventional Radiology
Lloyd Mark MD	Emergency Radiology, Nuclear Medicine
Albert Moreno, MD	Nuclear Medicine
Anthony Naylor, MD	General and Interventional Radiology
Norris Parks Ph.D	Radiation physics
Branko Plavsic, MD, PhD	Abdominal Radiology
Luis Ramos, MD	Neuroradiology
Arvin Robinson, MD, MPH	Pediatric Radiology
Jorge Sarmiento, M. D.	Diagnostic Ultrasound
Henry Uhrig, M. D.	Mammography
Jose Ulloa, M. D.	Mammography
John Winston, MS	Radiation Physics

EDUCATION COMMITTEE:

This committee, with faculty and resident representation, is charged with oversight of all issues related to the department's residency program. The committee is to meet monthly, more often as needed. The committee regularly evaluates the effectiveness of the residency program in meeting its goals and objectives, reviews resident and program evaluation, resident call and rotation schedules, and has input in choosing chief residents and resident award nominees. Residents who have issues to be addressed by the Education Committee are to bring them through the chief resident.

Branko Plavsic MD, PhD, Chairman

Noemi Brunner-Reynolds, M. D.

Melhem Ghaleb MD

Luis Ramos MD

Jorge Sarmiento MD

Chief Resident

Program Director (ex-officio)

EDUCATIONAL PROGRAMS

A. CURRICULUM

REQUIRED MONTHS

Abdominal Imaging(GI/GU), inc CT	6 months
Breast Imaging	3 months
Elective time	1 month
Emergency Radiology	Q 4 th night, 4 TH weekend
Magnetic resonance imaging	3 months
Musculoskeletal, including CT	4 months
Neuroradiology, inc CT & MRI	4 months
Nuclear radiology	4 months
Pathology/AFIP	6 weeks
Pediatric Radiology	4 months
Research	2 weeks
Thoracic, including cardiac & CT	6 months
Ultrasound (inc obstetrical and pelvic)	5 months
Vascular/Interventional radiology	6 months
Total	48 months

Rotation Schedule

	PGY 2 1 st	PGY 3 2 nd	PGY 4 3 rd	PGY 5 4 th
Chest (inc. CT)	2	2	1	1
Abdomen (inc. CT)	2	2	1	1
Pediatric (inc. CT)	1	2	0	1
US/ OB US	1	1	1	1
MRI	1	0	1	1
Neuroradiology	1	1	1	1
Interventional	1	2	2	1
Nuclear Radiology **	1	1	1	1
Musculoskeletal	1	1	1	1
Mammography	1	0	0	2
<i>Elective (inc.AFIP)</i>			3	
Total Months	12	12	12	12

**William Beaumont AMC

***RESIDENT
GOALS AND OBJECTIVES
BY
ROTATION***

The Department of Radiology follows the competency requirements set by the Accreditation Council for Graduate Medical Education (ACGME) and follows its guidelines. Each rotation, therefore, has incorporated these six competencies into its educational goals and objectives. These competencies are listed in ***RED*** at the beginning of each goal and/or objective. Residents receive these goals and objectives prior to the start of their rotations.

ABDOMINAL IMAGING

ABDOMINAL IMAGING

The radiology resident will rotate four months through abdominal imaging, which includes GI, GU, and abdominal CT, within the first two years of radiology residency. The final two rotations will be completed within the third and fourth year of the radiology residency program.

The learning experience takes place in the following ways: one-on-one training during the clinical workday; resident conferences given throughout the year, which will both be didactic and case conference in approach; weekly abdominal imaging conferences. General abdominal imaging textbooks and specific articles are recommended to the resident throughout the year.

I. First and second rotations (1st year)

GASTROINTESTINAL RADIOLOGY

The resident should:

Patient Care, Practice-based Learning and Improvement

- Learn the skills of fluoroscopy and become facile in the operation of the fluoroscope.
- o Develop hand/eye coordination during the examination.
- o Demonstrate competence in basic fluoroscopic procedures:
 - upper GI-single and biphasic,
 - esophagram-single and biphasic,
 - modified barium swallow study,
 - barium enema-single and double contrast,
 - small bowel exam-per oral and enterocolysis,
 - t-tube cholangiography, and
 - NJ and NG tube placement under fluoroscopy.

Medical Knowledge, System-based Practice

- o Become familiar with radiation concerns during GI fluoroscopy:
 - the various components contributing to patient radiation during the exam, and
 - methods to decrease both patient and staff radiation exposure without compromise of diagnostic outcome

Learn to discriminate between the diagnostic adequacies of various abdominal examinations.

- Learn of the appropriate use of various contrast agents related to the GI tract and the pancreaticobiliary tree, including adverse effects and safety precautions.

Develop a basic understanding of the normal, normal variants, and pathologic states of the oral pharynx, esophagus, stomach, duodenum, mesenteric small bowel, and colon as examined with contrast material. Demonstrate the ability to provide image interpretation of conventional images and ERCP examinations

Professionalism, Interpersonal and Communication Skills

- Recognize the importance of patient/MD relationship during the GI examination with proper respect for patient privacy, comfort, and safety.
- Demonstrate the importance of communication with the referring clinician, both in regards to a well crafted prompt report, as well as when to make immediate contact when pertinent abnormal findings are discovered at examination.

GENITOURINARY RADIOLOGY

The resident should:

Patient Care, Medical Knowledge, Practice-based Learning and Improvement

- Learn the basic skills of plain abdominal image interpretation and intravenous contrast examinations.
 - o Become facile in the performance of basic fluoroscopic procedures:
 - cystography,
 - voiding cystourethrography,
 - retrograde urethrography,
 - nephrostography, and
 - hysterosalpingography.
 - o Become familiar with radiation concerns during GU fluoroscopy, the various components of patient radiation exposure during the exam, and ways to decrease both patient and staff radiation exposure without compromising the diagnostic outcome.
- Demonstrate a basic understanding of the normal, normal variants, and pathologic GU anatomy.
- Learn the appropriate use of various contrast agents related to the GU tract.
 - Learn to recognize and treat contrast reactions

Professionalism, Interpersonal and Communication Skills

- Be aware of the importance of the patient/MD relationship during the GU examination.
- Be aware of the importance of communication with the referring clinician. This includes a well-crafted prompt report, as well as when to make immediate contact when pertinent abnormal findings are discovered at examination.

ABDOMINAL COMPUTED TOMOGRAPHY

Practice-based Learning, System-based Practice

- Understand the basic physics of CT including slice thickness, pitch, helical vs. multi-row scanners, effects of mA and kV.
- Learn the basic principles of contrast distribution particularly as applied to arterial and venous phase scanning.
- Demonstrate the ability to follow protocols and monitor CT studies. Modify protocols when appropriate. .
- Learn to recognize and treat contrast reactions.
- Develop skills in interpretation of basic CT pathology.

Interpersonal and Communication Skills, Professionalism

- Develop skills in consultation with house staff and referring physicians.
- Learn the appropriate format for dictation of CT reports

Medical Knowledge

Recognize the CT appearance of the following pathology

- Splenic and liver laceration
- Aortic dissection
- Aortic aneurysm and pseudoaneurysm
- Ascites
- Bowel perforation with free air
- Obstructive hydronephrosis due to ureteral calculus
- Bowel obstruction
- Active arterial extravasation
- Shock bowel
- Post traumatic urinary bladder leak

Colon carcinoma

- Esophageal carcinoma
- Liver cancer
- Pancreas cancer
- Gastric cancer

Renal Tumors

- Abdominal Lymphoma
- Retroperitoneal adenopathy

- Adrenal adenoma and myelolipoma
 - Gallstones
 - Cavernous hemangioma of the liver
 - Cirrhotic liver
 - Liver metastases
 - Pancreatitis with pseudocyst
 - Renal cystic disease
- CT artifacts

II. Third and Fourth Rotations (second year)

A. Gastrointestinal Radiology

Medical Knowledge, Patient Care,

• The residents will review the skill needed at fluoroscopy. Not only will the resident be instructed on how to become more facile with the fluoroscopic exam, he/she will also now be taught nuances to facilitate the various GI examinations at fluoroscopic exam. The resident should continue to increase in the facilitation of the basic GI examinations as stated under the first year rotations. A review and more information related to radiation concerns will be given. Further detail will be given to the GI tract pathology as begun in the first year rotations.

Practice Based Learning, System Based Practice

• There will be increasing application of correlation between cross-sectional images obtained prior or following the examination done in fluoroscopy. Also this resident should be made aware of the place of the various imaging techniques of the abdomen in order to structure an imaging approach to different clinical problems using fluoroscopy, plain film, and axial imaging studies.

B. GENITOURINARY RADIOLOGY

Patient Care, Medical Knowledge,

• The residents will review their skill of fluoroscopy. Not only will the resident be instructed on how to become more facile with the fluoroscopic exam, he/she will also be taught nuances to facilitate the various GU examinations at fluoroscopic exam. The resident should continue to increase their efficiency of the basic examinations as stated under the first year rotation.

• Further detail will be given to the GU tract pathology as begun in the first rotation.

Practice Based Learning, System Based Practice

• There will be increasing correlation between cross-sectional images obtained prior or following the examination done in fluoroscopy. The resident should be made aware of the place of various imaging techniques of the abdomen in order to structure an imaging approach to different clinical problems using fluoroscopy, plain film, and axial imaging studies.

Interpersonal and Communication Skill

• The residents should be able to assist in organizing the workday and working with the first year radiology residents.

C. ABDOMINAL COMPUTED TOMOGRAPHY

Medical Knowledge, Patient Care

- Refine interpretive skills with complex pathology.
- Understand the principles of computed tomography angiography
- Be able to identify life-threatening findings, particular in trauma patients.

Identify the CT appearance of the following pathology:

- Hepatic abscess
- Pancreatic abscess
- Renal abscess
- Groin pseudoaneurysm
- Biliary cancer
- Budd Chiari Syndrome
- Carcinomatosis with ascites
- Sequela of cryoablation
- Diaphragmatic hernia
- Interloop abscess
- Focal nodular hyperplasia of the liver
- Hepatocellular carcinoma
- Islet cell tumor of the pancreas
- Renal oncocytoma
- Complications of renal transplantation
- Cystic pancreatic neoplasm
- Portal hypertension and varices
- Retroperitoneal fibrosis
- Von Hippel Lindau Syndrome

Interpersonal and Communication Skills, Professionalism

- Provide emergent provisional interpretation as needed.

Practice Based Learning

- Demonstrate the ability to direct the choice of imaging modality and protocol emergent studies.
- Understand when referral to other imaging modalities is necessary.

III. Fifth and Sixth Rotations (Third and Fourth Years)

A. GASTROINTESTINAL RADIOLOGY

Practice Based Learning

- The resident should now be comfortable with the basic fluoroscopic exams and will be encouraged to further modify the basic exam to answer specific questions at fluoroscopy and develop their own fluoroscopic pattern. The resident should be able to demonstrate the ability to safely carry out all technical procedures.

Patient Care, Professionalism, Interpersonal and Communication Skills

- During these rotations, there will be brief reviews as needed in the following areas: radiation concerns, various contrast agents, patient/physician relationship, and the importance of reporting to the clinician.

Medical Knowledge

- There will be a continued discussion of the various pathologies related to the GI tract. with further axial imaging studies, these discussions can be carried into both CT, ultrasound, and MRI, as well as contrast and plain film abnormalities related to the abdomen and GI tract.

System Based Practice

Other imaging studies that are associated with the case should be correlated with the present exam in forming an understanding of imaging strategies for the order of examination.

B. GENITOURINARY RADIOLOGY

Patient Care, Medical Knowledge, Professionalism, Interpersonal and Communication Skills

- The residents should now be comfortable with the basic fluoroscopic exams and will be encouraged to further modify the basic exam to answer specific questions at fluoroscopy and develop their own fluoroscopic pattern.

- During this rotation there will be brief reviews as needed in the following areas: radiation concerns, various contrast agents, patient/physician relationship, safety precautions, and the importance of reporting to the clinician.

System Based Practice, Practice Based Learning

- There will be a continued discussion of the various pathologies related to the GU tract. With further axial imaging studies, these discussions can be carried into CT, MRI, and ultrasound as well as contrast and plain film abnormalities related to the abdomen and GU tract.

C. ABDOMINAL COMPUTED TOMOGRAPHY

Practice Based Learning and Improvement, Professionalism, Patient Care

- Continue to expand the knowledge of CT anatomy and pathology begun in the previous rotations.
- Assist technical staff in the performance of CT angiography and its interpretation.

Medical Knowledge,

Identify the CT appearance of the following pathology:

- CT angiography of endostent placement
- Renal artery stenosis
- Accessory renal arteries
- Virtual colonoscopy

References:

Federle et al: Diagnostic Imaging Series, Abdomen. Saunders 2005
Halpert RD: Gastrointestinal Imaging, The Requisites, 3rd edition. Mosby 2006
ACR Syllabus, on disc.

CHEST

All residents will receive six months of instruction in chest imaging, including CT and cardiac imaging. Clinical responsibilities will include all chest imaging with the specific goals and objectives listed below for each year of training.

Year One: First and Second rotations

Goals

Professionalism, Medical Knowledge, Interpersonal and Communication Skills, System-based Practice, Practice Based Learning and Improvement

After completion of the first year chest rotations, resident should;

- Demonstrate a responsible work ethic.
- Demonstrate learning of knowledge-based objectives.
- Accurately and concisely dictate a chest imaging report.
- Communicate effectively with referring clinicians and supervisory staff.
- Understand the principles of standard patient positioning in chest imaging.
- Demonstrate knowledge of the “ACR Standards for Communication, Adult Chest”.
- Demonstrate the ability to obtain pertinent patient information relative to chest imaging examinations.

Objectives

Medical Knowledge

At the end of the first-year chest rotations, the resident should know basic radiological presentation of;

- Normal anatomy of the chest in regard to heart, lungs, mediastinum, and bony thorax
- Interstitial lung disease
- Alveolar lung disease
- Monitoring and support devices – “tubes and lines”
- Mediastinal masses
- Solitary and multiple pulmonary nodules
- Acute chest trauma
- Chest wall, pleura and diaphragm
- Upper lung zone disease
- Atelectasis
- Peripheral lung disease
- Central and peripheral airways
- Unilateral hyperlucent lung
- Neoplasms of the lung
- Immunocompromised lung disease
- Congenital and acquired heart disease

Interpersonal and Communication Skills, Professionalism.

At the end of the first year rotations, the resident should be able to:

Dictate understandable chest imaging reports that include date of comparison exam, type of exam, indication for exam, brief and concise description of the findings and short impression.

Call ordering physicians about all significant or unexpected imaging findings and document who was called and the date and time of the call in the dictated report.

Determine when it is appropriate to obtain immediate help from supervisory faculty on duty in answering questions for referring clinicians.

Arrive for the rotation assignment on time and be prepared for interpretation sessions by reviewing recommended study materials.

Practice Based Learning and Improvement

Utilize previous imaging exams and reports (e.g. prior chest images and/or CT scans) in the interpretation of current studies.

Obtain relevant patient history from computer records, dictated reports, or by calling referring clinicians
Conferences and study materials

Weekly resident chest conference.

Residents are expected to place one case into the teaching file, each rotation. The case should have references to indicate an understanding of evidence-based medicine.

Study materials

Thoracic Radiology: The Requisites, by McCloud TC, Mosby, St. Louis, 1998.

Chest Radiology: Plain Film Patterns and Differential Diagnoses, Reed, 5e, Mosby, St. Louis, '03

Year Two: Third and Fourth one-month rotations

Goals

Medical Knowledge, Systems-based Practice

After completion of the second year chest rotations, the resident will

Demonstrate more advanced knowledge of learning objectives

Continue to build on chest imaging and CT interpretive skills.

Demonstrate an understanding of "ACR Appropriateness Criteria" for chest radiology.

Objectives

At the end of the second year chest rotations, the resident should be able to:

Medical Knowledge

demonstrate more advanced knowledge of the objectives introduced in Year One.

Practice Based Learning and Improvement

Appropriately protocol all requests for chest CT, given the patient histories.

Interpersonal and Communication Skills, System based Practice

Demonstrate the ability to effectively present interesting cases at the radiology case conference to other residents by choosing and showing appropriate interesting or quality assurance cases, interacting with residents and guiding them through the cases, and being prepared to present brief discussion of the diagnoses for each case.

Acts as a consultant for referring clinicians, recommending appropriate imaging studies based on "ACR Appropriateness Criteria."

Patient Care

Demonstrate the ability to safely manage a patient contrast reaction that occurs during a chest CT examination.

Conferences

Same as for Year One.

Study Materials

Chest- Diagnostic Imaging Series by Gurney. Amirsys, 2006

Thoracic Imaging – Pulmonary and Cardiovascular, by Webb, Higgins, Lippicott, 2005

Years Three and Four: Fifth and Sixth one-month rotations

After completion of the third and fourth year chest rotations, the resident should be able to:

Medical Knowledge, Interpersonal and Communication Skills, Practice Based Learning and Improvement

Demonstrate thorough learning of knowledge-based objectives.

Refine skills in interpretation of images and CT scans of the chest.

Develop skills in protocoling, monitoring, and interpretation of HRCT scans.

Become a more autonomous consultant and teacher.

Correlate pathological and clinical data with imaging and chest CT findings.

Objectives

At the end of the sixth chest rotation, the resident should;

Medical Knowledge

Demonstrate a thorough knowledge of the objectives introduced in Year One, in addition to the objectives listed below:

Identify a secondary pulmonary lobule on HRCT.

Identify and give appropriate differential diagnoses when the patterns of septal thickening, perilymphatic nodules, bronchiolar opacities (“tree-in-bud”), air trapping, cysts and ground glass opacities are seen in HRCT.

Identify the major anatomic structures of the chest and mediastinum on chest CT and MRI.

Recognize normal vascular anatomy and pathological processes in the chest.

Interpersonal and Communication Skills, Professionalism

Dictate accurate, concise chest imaging and CT scan reports

Practice Based Learning and Improvement

Correctly protocol all HRCT exams, obtaining inspiratory, expiratory and prone images when needed,

Present an interesting cardiopulmonary case, with a confirmed diagnosis, correlating clinical history with pathology and imaging, to residents and faculty.

Work in the reading room independently, assisting clinicians with radiologic interpretation and teaching other residents and medical students assigned to chest radiology.

Refine techniques of reformatting chest CT images for vascular detail.

Conferences

Same as for Year One.

Study Materials

High Resolution CT of the Lung, Webb, Müller, Naidich, 3rd ed, Lippincott-Raven, Phila, 2000.

ACR CD-ROM Chest Teaching File

EMERGENCY

Goals

Patient Care, Professionalism, Interpersonal and Communication Skills

Radiology residents will rotate through the Emergency Section on nights and weekends during all four years of training. Over this time, it is expected that residents will progressively develop their abilities to interpret imaging studies of emergency patients. Residents will be taught the practical clinical skills necessary to interpret CR images. The skills to interpret “after hours” Neuroradiology, Ultrasound, Chest, Abdomen and Musculoskeletal CT scans, Nuclear Radiology, GI/GU and MRI exams will be taught in each of those specific sections. The residents will learn about Musculoskeletal, Chest and Abdominal conditions, which can be seen in an Emergency Radiology situation. The radiographic abnormalities will be taught with one-on-one teaching and in Radiology Conference presentations. A recommended reading list is provided to assist the radiology residents with their individual study efforts to learn about radiographic findings in these emergent conditions/diseases. The residents will learn to dictate concise and appropriate radiographic reports and to serve as consultants to referring physicians.

During the day (Mon-Fri 8AM-5PM) , the resident will learn to provide prompt written or phone reports for Emergency patients and other Out-patient Clinic patients which need a STAT report through their daytime assigned rotations. During the evening hours and on weekends, the resident will also provide STAT preliminary reports in an efficient and professional manner.

First year Residents

Evening (5-10 PM only for first 6 months, then alternating with 5pm-8am) & Weekends/ holidays (8 AM-5 PM or 5pm-8am after 6 months of training)

Knowledge Based Objectives

Medical Knowledge

Learn the basic principles of musculoskeletal, chest and abdominal radiology with an emphasis on normal anatomy and normal variants on CR exams.

Learn the types of injuries and pathophysiology associated with acute trauma, and acute medical and surgical conditions.

Develop skills in the interpretation CR of the chest, musculoskeletal and abdomen diseases in the setting of acute trauma.

Understand the basic physics of radiography and computed radiography.

Learn the basic principles of interpreting the emergent Nuclear Medicine exams: eg. V/Q lung scans, cerebral blood flow studies.

Decision-Making/Value Judgment Skills

Patient Care

Learn how to promptly provide a preliminary interpretation of CR examinations and then review the preliminary interpretations with an attending radiologist.

If there are any changes from the preliminary, the radiology resident should contact the appropriate referring physician and give the final interpretation report.

Learn when to request a Pediatric radiology consultation for a complex child case (such as intussusception or child abuse).

Learn the basic principles of assessing a portable C-spine, T- spine or lumbar spine exam to “clear” it before the radiologic technologist performs a complete spine exam.

Interpersonal and Communication Skills, Professionalism

Learn the appropriate format for dictation of reports, using PowerScribe.

Develop skills in providing consultations for house staff and clinic physicians on routine emergent imaging studies.

Learn how to interact professionally with the attending Radiologist and attending Emergency physicians on emergent radiologic exams.

Second, Third, and Fourth Year Residents

Evening (5-10 PM alternating with 5pm-8am) & Weekends/ holidays (8 AM-5 PM or 5pm-8am)

Knowledge Based Objectives

Medical Knowledge

Develop a more detailed understanding of the basic pathology and pathophysiology of trauma, tumors, infections, and inflammatory diseases.

Continue to develop skills in the interpretation of emergent studies begun in the first year.

Learn the CT findings of acute/emergent diseases.

Continue to expand knowledge of the anatomy, especially on cross-sectional imaging modalities.

Learn to prepare and present cases in clinical conferences for QA, teaching, and management

Decision-Making and Value Judgment Skills

Patient Care, Interpersonal and Communication Skills, Professionalism, System Based Practice, Practice Based Learning and Improvement

Direct the choice of imaging modality and protocol emergent studies.

Demonstrate the ability to identify those cases that require the additional expertise in assessment of imaging studies. Learn when to call an attending radiologist to provide expertise for complex CT, US, or fluoroscopic exams.

Consult on Level 1 and Level 2 Trauma Emergencies to coordinate emergency radiologic exams and interpretations.

Protocol and monitor CT, US, and MRI studies. Learn to set up and refine imaging protocols in CT and MRI based on specific clinical indications. Be able to modify imaging protocols based on identification of unexpected or novel findings at the time of scanning.

Act as a consultant for house staff and attending physicians in the Emergency Department.

Provide emergent provisional interpretations of CR, CT scans and Ultrasound scans as needed.

Direct the choice of imaging modality and protocol emergent studies.

Identify those cases that require the additional expertise in assessment of imaging studies

Emergency Radiology Curriculum

Adapted from the Society of Emergency Radiology Edited By R. A. Novelline, MD

Objective:

To define the content, structure for residents in Emergency Radiology.

Medical Knowledge

Central Nervous System

Skull fractures

Brain

Extra-axial hemorrhages: subdural and epidural hematoma

Parenchymal injuries: cortical contusion, gray matter, brainstem

Subarachnoid hemorrhage, Vascular injuries

Penetrating injuries

Herniation syndromes

Cerebral infarction: arterial infarction, venous infarction,

Diffusion perfusion imaging appearance Non-traumatic hemorrhage

Subarachnoid, parenchymal hemorrhage

Central Nervous System infections

Meningitis, abscess/cerebritis, subdural empyema

Dural sinus thrombosis

Reversible posterior leukoencephalopathy syndrome

Pituitary apoplexy

Face and Neck

Facial fractures

Orbital fractures: blow-out fracture
Zygoma , Isolated arch, zygomatic complex
Nasal fractures, naso-orbital-ethmoid fractures
Frontal fractures
Maxillary fractures: dentoalveolar, maxillary sagittal, LeFort

Mandible fractures
Ocular injuries: rupture, cellulitis
Paranasal sinusitis

Spine

Initial assessment issues = "Clearance" in the Emergency Department.

The evaluation of low-risk patients; high-risk patients (multitrauma), and patients with neurologic deficits

Concept and assessment of instability.

Concept of: mechanism of injury, radiographic patterns, normal variants, frequent types of injuries

Cervical Trauma

Cranio-cervical / C1-C2
Occipital condyle fracture
Atlanto-occipital dislocation / subluxation
Jefferson burst fracture, C1 - posterior arch
Dens fracture, Hangman's fracture
Anterior subluxation / whiplash syndromes
Hyperextension sprain / spinal cord injury without radiographic abnormalities
Wedge compression, spinous process fractures
Burst compression, flexion tear drop fracture, facet dislocation
Articular mass and transverse process fractures
Corner avulsion fracture (extension teardrop)
Laminar fractures
Facet dislocation with fracture
Thoraco-lumbar trauma
Compression fracture, burst fracture
Chance fracture, complex fracture-dislocation
Pathological fracture, traumatic injuries to intervertebral disks
Osteomyelitis /discitis, epidural abscess

Chest

Chest trauma

Rib fractures, sternal and manubrial fractures
Hemothorax, mediastinal hemorrhage
Pneumothorax and pneumomediastinum
Pulmonary contusion, laceration, hematoma
Tracheobronchial injury
Esophageal tear, diaphragm injury
Pulmonary embolism
Acute pulmonary infections
Aspiration pneumonia
Airway foreign bodies Obstructive airway disease
ARDS: near-drowning, fat embolism syndrome
Esophageal rupture

Cardiovascular Emergencies

Myocardium and Pericardium

Myocardial infarction, laceration, contusion
Pericardial effusion. tamponade, pneumopericardium

Aorta laceration, dissection, aneurysm

Pulmonary edema, various etiologies

Pulmonary embolism

Abdomen

Abdominal Trauma

Hemoperitoneum and intraperitoneal fluid

- Hemodynamic status assessment
- Retroperitoneal hemorrhage
- Gas collections: intraperitoneal and retroperitoneal
- Active arterial extravasation on CT
- Splenic and liver injuries
- Gallbladder and biliary injuries
- Bowel and mesenteric injuries
- Pancreatic injuries
- Renal and adrenal injuries
- Bladder injuries: intraperitoneal and extraperitoneal
- Abdominal wall injuries and diaphragmatic hernias

Non-traumatic Abdominal Emergencies

Peritoneal cavity

- Ascites, peritonitis, abdominal abscess
- Liver and biliary tract
- Jaundice: obstructive and non-obstructive
- Cholecystitis, pancreatitis
- Urinary tract
- Urinary stones, infection
- Pyelonephritis, renal abscess
- Gastrointestinal tract
- Gastrointestinal hemorrhage
- Bowel obstruction, bowel infarction, bowel infection
- Appendicitis, diverticulitis, Infectious enteritis and colitis
- Inflammatory bowel disease: Crohn disease, ulcerative colitis

Male Genitourinary emergencies

Urethral and penile trauma, foreign bodies, stones

Scrotal and testicular trauma

Acute non-traumatic scrotal conditions

- Testicular torsion
- Epididymitis, Orchitis, Epididymoorchitis
- Acute fluid collections (Hydrocele, hematocele, pyocele)
- Infarction, Fournier's Gangrene
- Abcess

Upper Extremity

Dislocations:

- Scapulothoracic, Clavicle
- Sternoclavicular, Acromioclavicular, Glenohumeral , elbow

Fractures:

- Scapular fractures
- Humerus fractures
- Proximal (head & neck), Shaft, Supracondylar, intra articular, including unicondylar, bicondylar and capetellar
- Forearm fractures, wrist

Pelvis and Hip

Pelvis

Fractures of isolated bones of the pelvis that do not involve the pelvic ring

- iliac wing (Duvrney), sacrum, coccyx
- avulsion: ant. sup. iliac crest apoph. - sartorius m
- ant. inf. iliac crest apoph. - rectus femoris m

- ischial tuberosity - hamstring ms
- lesser troch. apoph. (femur) – iliopsoas
- Pelvic ring disruption. Disruption, ie., fracture or diastasis at two or more sites, the anterior and posterior pelvic arcs.
 - diffuse: open-book pelvic ring disruption
 - vertical shear
 - Types of pelvic ring disruption
 - Malgaigne (ipsilateral)
 - open - book
- Insufficiency fractures, Stress fractures
- Acetabular fractures (Involve only one side of the pelvic ring.
- Posterior column (most common) rim, anterior column, both columns
- Hip**
- Dislocation
 - Posterior or posterosuperior pure fracture-dislocation. Fracture involves posterior or posterosuperior acetabular rim
 - Anterior (obturator)
- Fractures (usually associated with dislocation).
 - Posterior or posterosuperior acetabular rim
 - Anterior (Involve the acetabular "tear-drop")
- Proximal femur
 - Slipped capital femoral epiphysis (SCFE)
 - Salter-Harris physeal injuries
 - Fractures
- Head - usually associated with hip dislocation
- Neck - subcapital, transcervical, basicervical
- Trochanteric, intertrochanteric
- subtrochanteric, isolated fracture, greater trochanter
- Avascular necrosis
- Lower Extremity
 - Fractures:
 - Femoral shaft, Patella fractures
 - Tibial plateau, Tibial spine avulsion
 - Tibial stress fractures, tibial and fibular shaft fractures
 - Tibial plafond fracture (pilon fractures), ankle mortise injury,
 - Tarsal fractures, metatarsal fractures, Toe fractures
 - Cruciate and other ligamentous injuries of the knee, Meniscus tears
 - Achilles tendon and ligamentous injuries of the ankle
 - Knee dislocations, Tarso-metatarsal fracture dislocations (Lisfranc.s fracture)
 - Septic arthritis, Diabetic foot infections
 - Compartment syndrome

MAGNETIC RESONANCE IMAGING

Through the four year residency in diagnostic radiology, each resident competes three, one-month rotations in MRI. The following outline presents the goals and objectives for each rotation.

First Rotation

Goals

Medical Knowledge, Practice Based Learning and Improvement, Interpersonal and Communication skills, Patient Care.

Understand the basic physics of MR including TR, TE, T1W, T2W, Spin echo, Gradient Recall Echo imaging, and Inversion Recovery.

Learn the basic principles of contrast distribution, particularly as applied to arterial and venous phase scanning.

Protocol and monitor MR studies. Modify protocols when appropriate.

Understand the principle of a saline chaser.

Learn to recognize and treat contrast reactions.

Develop skills in interpretation of basic MR pathology.

Learn the appropriate format for dictation of MR reports.

Objectives

Medical Knowledge

Identify the MR appearance of the following pathology:

Liver cancer

Benign liver lesions such as cysts and hemangioma

Pancreas cancer

Lymphoma

Retroperitoneal adenopathy

Aortic Aneurysm

Aortic Dissection

Adrenal adenoma and cancer

Gallstones

Cholelithiasis

Ascites

Cirrhotic liver

Pancreatitis with pseudocyst and necrosis

Renal cystic disease

Obstructive hydronephrosis due to ureteral calculus

Active arterial extravasation

Second Rotation

Goals

Medical Knowledge, Interpersonal and Communication skills, Professionalism, Patient Care, Problem Based Learning and Improvement, System Based Practice

Refine interpretive skills with complex pathology.

Understand the principles of Magnetic Resonance angiography.

Demonstrate ability to identify life-threatening findings, particularly with aortic aneurysms and grafts.

Provide emergent provisional interpretation as needed.

Demonstrate ability to direct the choice of imaging modality and protocol emergent studies.

Understand when referral to other imaging modalities is necessary.

Objectives

Medical knowledge

Identify the MR appearance of the following pathology.

- Hepatic abscess
- Pancreatic abscess
- Renal abscess
- Groin pseudoaneurysm.
- Biliary cancer
- Budd-Chiari Syndrome
- Carcinomatosis with ascites
- Sequela of cryoablation
- Diaphragmatic hernia
- Focal nodular hyperplasia of the liver
- Hepatocellular carcinoma
- Islet cell tumor of the pancreas
- Renal oncocytoma
- Cystic pancreatic neoplasm
- Renal hypertension and varices
- Retroperitoneal fibrosis
- Von Hippel Lindau Syndrome

Third Rotation

Goals

Medical Knowledge, Interpersonal and Communication Skills, Professionalism, Patient Care

- Continue to expand the knowledge of MR anatomy and pathology begun in the first two rotations.
- Assist technical staff in performance of CT angiography and its interpretation.
- Demonstrate ability to be a more autonomous consultant and teacher

Objectives

Medical Knowledge

Identify the MR appearance of the following pathology:

- MR angiography of liver transplant candidates
- Renal artery stenosis
- Accessory renal arteries.
- Thoracic outlet syndrome
- Uterine fibroids
- Uterine anomalies
- Ovarian cysts
- Ovarian cancer
- Pelvic abscess
- Cardiac MR imaging including functional cardiac assessment
- Arrhythmogenic right ventricular dysplasia
- Cardiac perfusion imaging
- Myocardial viability
- Adult congenital heart disease
- Pediatric congenital heart disease
- Valvular heart disease

Body MR suggested Reading:

Body MRI:

1. Abdominal-Pelvic MRI. Semelka. Wiley-Liss. 2002.
2. Body MRI. Siegelman. Saunders. 2005
3. Clinical Magnetic Resonance Imaging. Saunders. 3rd Edition. 2006.
4. CT and MRI of the Abdomen and Pelvis: A Teaching File. Ros. Williams and Wilkins. 1997
5. Magnetic Imaging Review. Lippincott Williams. Wheeler. March 1996.
6. Magnetic Resonance Imaging. Stark. Mosby. 1999.
7. Magnetic Resonance Imaging of the Body. Higgins. November 1996.
8. Pocket Atlas of MRI Body Anatomy. Berquist. August 1995.
9. Primer on MR Imaging of the Abdomen and Pelvis. Martin. Wiley. 2005.
10. Sectional Anatomy by MRI. 2nd Edition. El-Khoury. Churchill-Livingstone. 1995.
11. Variants and Pitfalls in Body Imaging. Shirkhoda. Lippincott. 1999.

Cardiac MRI:

1. Cardiac Imaging. The Requisites. Miller. Saunders. 2005.
2. Cardiovascular Magnetic Resonance. Manning. Saunders. 2002
3. Cardiovascular MRI and MRA. Higgins. Lippincott Williams. Sept. 2002.
4. Cardiovascular MR Imaging: Physical Principles to Practical Protocols. Lee. Lippincott Williams. December 2005.
5. Clinical Cardiac MRI. Bogaert. Springer. 2005.
6. MRI and CT of the Cardiovascular System. Higgins. Oct 2005.

MRI Physics:

1. How does MRI Work? Weishaupt. Springer. 2003.
2. Magnetic Resonance Imaging: Physical Principles and Sequence Design. Haacke. Wiley. 1999.
3. MRI Principles. Mitchell and Cohen. Saunders. 2004.
4. MRI: The Basics. Hashemi. Lippincott Williams. Sept 2003.
5. Questions and Answers in Magnetic Resonance Imaging. Elster. Mosby. 2001.

Mammography

Residents complete three one-month rotations in mammography, which includes breast ultrasound, breast interventional procedures, and breast MRI during their radiology residency. The first rotation is taken during the first two years of training, the second rotation during the third year, and the final rotation during the last year of residency. This schedule allows residents to be qualified to interpret mammograms independently after successful completion of their residency. Residents are instructed in breast anatomy, physiology, pathology, mammography interpretation and problem solving methodology, equipment and quality control issues, breast ultrasound, breast interventional procedures, mammographic reporting, and medicolegal aspects of mammography.

First Rotation

Goals

System Based Practice, Patient care, Interpersonal and Communication Skills

- Demonstrate ability to dictate a mammogram report and be able to apply ACR lexicon and use BIRADS
- Understand basic mammographic positioning
- Demonstrate ability to obtain pertinent patient information and determine if a mammogram is screening or diagnostic study.
- Begin to understand the work-up and evaluation process for breast masses and calcifications.

Objectives

Medical Knowledge, System Based Practice, Patient Care, Professionalism

At the end of the first rotation, the resident should demonstrate knowledge of the following:

- Normal breast anatomy
(identify normal breast structures including skin, Cooper's ligaments, pectoral muscle, inframammary fold, retromammary fat.)
 - Demonstrate ability to determine if the standard CC and MLO views are performed adequately by the ACR criteria
 - Use ACR Lexicon for describing calcifications and masses
 - Define TDLU (terminal duct lobule unit)
 - Evaluate calcifications and determine whether they appear benign or malignant depending on their morphology and distribution. Be able to recognize obviously benign calcifications such as, fat necrosis, secretory disease, and dystrophic calcifications, indeterminate calcifications, and malignant calcifications.
 - Evaluate breast masses and determine if they are most likely benign or malignant depending on their morphology, density, and margins. Be able to differentiate cysts, fibroadenomas, hematomas, phyllodes tumors, intramammary lymph nodes, and malignancy
 - Understand basic role of breast ultrasound in evaluating breast masses
 - Understand basic principles of and be able to discuss indications and contraindications in performing a core biopsy.
 - Develop skills in performing needle localizations and cyst aspirations under mammographic/ultrasound guidance, be able to describe principles, indications, contraindications for excisional biopsies
 - Demonstrate ability to evaluate specimen radiographs for adequacy of excisional biopsy
 - Demonstrate ability to localize lesion in the breast from the mammographic images and ability to apply the triangulation principle.
 - Select 4-5 mammography biopsy cases and present a mammography case conference

Second Rotation

Goals

Medical knowledge, Patient Care, System Based Practice

Continue to develop mammographic skills and start to develop problem-solving techniques
Become familiar with breast MRI
Expand knowledge base of pathologic processes of the breast.
Demonstrate an understanding of breast physiology
Demonstrate an understanding of basic mammographic QA.
Select 4-5 mammography biopsy cases and present a mammography case conference

Objectives

Interpersonal and Communication Skills, Medical Knowledge, Professionalism

By the end of the second mammography rotation the resident should be able to

- discuss indications and techniques to perform diagnostic mammographic views including spot compression views, magnifications views, 90 degree ML or LM views, rolled views, axillary tail, implant displaced views, tangential views, exaggerated CC views.
- describe the different subtypes of ductal carcinoma in situ
- define and identify breast implant ruptures both intra and extracapsular. Be able to discuss workup of patients with suspected implant rupture and limitations and indications of mammography, US, and MRI.
- identify which part of the TDLU that specific cancers arise from (ductal versus lobular)
- recognize physiologic changes from mammographic findings including weight changes, HRT, lactation, CHF, renal failure, venous or lymphatic obstruction, infection, radiation changes.
- discuss indications for performing FNA under US guidance and be able to perform these procedures
- perform mammo/path correlation on all FNA procedures performed
- describe daily (processor QC and sensitometry), weekly (phantom image testing), quarterly (fixer retention test, repeat analysis), semiannual (darkroom fog, screen-film contact test, compression device performance), and annually (AEC, focal spot condition, radiation output etc) QA Tests.
- describe indications and limitations of breast MRI (prelumpectomy patients, high risk patients, implant patients, post biopsy patients looking for recurrence, lesions only seen on one mammo view in a dense breast)

Third Rotation

Goals

Interpersonal and Communication Skills, Medical Knowledge, Professionalism, System Based Practice

Expand on problem solving techniques for mammographic evaluation
Expand on breast MRI knowledge base
Demonstrate ability to discuss screening mammography data and controversies; be familiar with most recent recommended screening guidelines and screening theory
Learn requirements of mammography audit
Familiarity with ACR Mammography Quality Control Manual
Familiarity with ACR and FDA requirements for accreditation
Familiarity with medicolegal problems of breast imaging.
Select 4-5 mammography biopsy cases and present a mammography case conference

MUSCULOSKELETAL

The musculoskeletal radiology rotation includes 4 one-month rotations, one in each year of training. During each rotation, the resident is actively involved in the management and interpretation of musculoskeletal plain films, MR and CT examinations from the emergency room, orthopedic surgery clinic, primary care clinics and in-patients. (patient care) In addition, the resident has the opportunity to learn protocols for CT and MRI examinations of the spine and the extremities. (practice based learning and improvement) The resident is expected to have an understanding of the underlying anatomy, physiology, and pathology of the musculoskeletal system. (medical knowledge) In addition, the resident will need to know the relative indications and advantages and disadvantages of different imaging modalities, such as plain films, CT scanning, radionuclide bone scanning, and MR scanning. (system based practice) During interpretation of the films, the resident is expected to recognize conditions that require urgent or emergency management. These cases need to be quickly reviewed with supervising faculty, and then the appropriate clinical staff contacted with results of the study. (Interpersonal and communication skills) When dealing with patients and technologists, the resident will be expected to demonstrate professional behavior in all situations. (professionalism) The didactic material for the rotations will be drawn from the curriculum for musculoskeletal radiology developed by the Education Committee of the Society of Skeletal Radiology and the American Society of Musculoskeletal Radiology. In addition, the resident will need to learn common orthopedic procedures used for treatment of spine and sports medicine pathology. They will also learn proper imaging parameters of MR Imaging and how to interpret in detail MR Imaging of the spine and extremities. In addition to these imaging skills, the resident will be expected to learn the techniques for fluoroscopic guided injections of peripheral joints as needed for arthrography.

First rotation

Goals

Professionalism, Medical Knowledge, Patient Care, Practice Based Learning and Improvement, Interpersonal and Communication Skills

After completion of the first musculoskeletal rotation, the resident will:

- Demonstrate a responsible work ethic
- Demonstrate learning of knowledge based objectives
- Accurately and concisely dictate a skeletal radiograph report
- Communicate effectively with referring clinicians and supervisory staff
- Understand standard patient positioning in skeletal radiology
- Demonstrate the ability to obtain pertinent patient information relative to radiologic examinations.

Objectives

Medical Knowledge, Interpersonal and Communication Skills

At the end of the first musculoskeletal rotation, the resident will demonstrate learning of the entities included in the congenital anomalies and trauma section of the musculoskeletal objective. *These objectives are outlined in detail and available upon request:*

- Congenital and Developmental Abnormalities
- Trauma
- Joint Disorders
- Infection
- Tumors and Tumor-Like Lesions

Basic metabolic, systemic, and hematological disorders

Second rotation

Goals

Medical Knowledge, Practice Based Learning and Improvement, Interpersonal and Communication Skills, System Based Practice

After completion of the second musculoskeletal rotation, the resident will:

Demonstrate knowledge-based learning objectives with emphasis on infections and joint disorders, neoplasms and arthritis.

Continue to build on image interpretive skills

Develop protocol skills, monitoring, and interpreting musculoskeletal CT scans

Develop skills in interpretation of musculoskeletal MRI

Objectives

The resident will demonstrate learning of the tumors and arthritis section of the musculoskeletal objectives.

Third and Fourth rotations

Goals

Medical Knowledge, Practice Based Learning and Improvement, Interpersonal and Communication Skills

After completion of the third musculoskeletal rotation, the resident will:

Demonstrate learning of knowledge-based objectives with emphasis on congenital tumors by metabolic and hematologic disorders

Refine skills in interpretation of imaging of the musculoskeletal system

Develop skills in interpretation of musculoskeletal MRI

Become a more autonomous consultant and teacher

Objectives

At the end of the fourth musculoskeletal rotation, the resident will demonstrate thorough knowledge of the **knowledge-based** musculoskeletal objectives previously listed.

NEURORADIOLOGY

Goals

Residents rotate through the Section of Neuroradiology during each of their four years of training. Over this time, it is expected that residents will progressively develop their abilities to perform and interpret imaging studies of the central nervous system. Residents will be taught the practical clinical skills necessary to interpret plain radiographs, CT scans, and MRI exams of 1) brain and skull; 2) spinal cord and vertebral column and; 3) head and neck. **(Patient Care)** They will be instructed in the performance and interpretation of invasive procedures including cerebral angiography, myelography/spinal canal puncture, and imaged guided biopsies of the spine and skull base. **(Practice Based Learning and Improvement)** Interventional procedures will also be covered during the Vascular and Interventional rotations. The goals and objectives listed below are, therefore, outlined by level of training. The residents will receive instruction in the science that underlies clinical neuroradiology, in particular neuroanatomy and neuropathology. They will learn the physical principles of CT, MR, conventional radiography, and angiography. **(Medical Knowledge)** They will learn the relative value of each modality, enabling them to choose the appropriate study and the appropriate protocol for each patient. **(System Based Practice)**

It is expected that residents will participate in the performance of examinations done by the section. They will obtain consents and perform intravenous injections of contrast. In order to perform these duties, the residents will learn the indications and contraindications for contrast administration. They will learn to recognize and treat adverse reactions. Residents will protocol and monitor CT and MR exams after they have demonstrated a sufficient level of knowledge and experience to perform these tasks. Residents will aid in the performance of invasive procedures including angiograms, myelograms, spinal taps and vertebral biopsies. **(Practice Based Learning)** They will learn to explain these procedures to the patients and their families obtain pre-procedure consent and write pre- and post-procedure orders. **(Interpersonal and Communication Skills, Professionalism)** They will learn techniques of arterial puncture, catheter choice and manipulation, and contrast dosage. They will learn to recognize and treat complications of these invasive procedures. **(Practice Based Learning and Improvement)** The residents will learn to dictate concise and appropriate radiographic reports and to serve as consultants to referring physicians. **(Interpersonal and Communication Skills)**

First Rotation

During the first rotation, the resident should;

Medical Knowledge

Learn the basic principles of neuroradiology with an emphasis on normal anatomy of the skull, brain, spine, spinal canal, and head and neck as identified on plain radiographs, CT, and MRI.

Develop skills in the interpretation plain films of the skull, facial bones and spine in the setting of acute trauma.

Learn to interpret CT scans of the brain, spine, and head and neck with a particular emphasis on studies performed on individuals presenting with acute or emergent clinical abnormalities.

- Brain - Infarction, spontaneous intracranial hemorrhage, aneurysmal subarachnoid hemorrhage, traumatic brain injury, infection, hydrocephalus, brain edema, and brain herniation.
- Head and Neck - fractures (orbital, facial and petrous), infection (sinusitis, orbital cellulitis, and neck abscess) and airway obstruction.
- Spine - trauma (stable and unstable injuries), degenerative disease, infection, neoplasm (vertebral metastases), and cord compression.

Understand the basic physics of computed tomography (CT). Be familiar with various standard CT imaging protocols and imaging techniques including:

- Use of various window and level settings;
- Use of soft tissue and bone algorithms;

Options in selecting slice thickness, interslice gap, and helical / multi-row scanner imaging parameters.
Learn the basic physical principles of MRI and be able recognize and understand the clinical value of commonly utilized pulse sequences.
Recognize and understand common imaging artifacts.

Patient Care, Interpersonal and Communication Skills, Practice Based Learning and Improvement

Learn to obtain informed consent, by explaining the risks and benefits of contrast enhanced CT/MR to the patient.
Learn appropriate techniques for injection of contrast (including use of power injectors).
Learn to recognize and treat contrast reactions.

Interpersonal and Communication Skills

Learn the appropriate format for dictation of reports of neuroradiologic imaging studies.
Develop skills in providing consultations for house staff and referring physicians on routine and emergent imaging studies.

Second Rotation

Medical Knowledge, Practice Based Learning and Improvement, Patient Care

Continue to expand knowledge of the anatomy of the brain and spine.
Become familiar with the complex anatomy of the orbit, petrous bone, skull base and soft tissues of the neck (supra- and infra hyoid) as displayed on plain radiographs CT and MR. Have knowledge of established anatomic classification systems for each of these areas.
Advance proficiency in the interpretation of plain radiographs and CT scans of the brain, head and neck, and spine.
Develop a greater understanding of the basic pathology and pathophysiology of disease of the brain, spine, and head & neck including neoplastic and inflammatory lesions.
Continue to develop skills in the interpretation of emergent studies begun in the first year. Learn the imaging features CT and MR of hyperacute infarction. Become familiar with the use of MR sequences (diffusion, perfusion, and MR spectroscopy) for the detection of these lesions
Develop the ability to use imaging findings to differentiate different types of focal intracranial lesions based on anatomic location (e.g. intra- vs. extra-axial), contour, intensity and enhancement pattern.
Learn to identify and differentiate diffuse intracranial abnormalities (e.g. hydrocephalus and atrophy).
Learn the vascular anatomy of the neck and head as displayed on catheter, MR, and CT angiography. Learn the indications, limitations, risks and benefits for each technique used for visualization of vascular anatomy.
Develop a more detailed understanding of causes of density changes on CT and intensity changes on MR in a variety of lesions (e.g. intracranial hemorrhage).
Become proficient at the assessment of the spine and contents of the spinal canal using a variety of imaging techniques including plain radiographs, CT, MR and myelography. The resident should;
1. understand spinal anatomy as displayed on multiplanar images including reformatted helical CT scans and MR scans,
2. be able to diagnose and differentiate degenerative spinal diseases including disc herniations, spinal stenosis, endplate changes, and facet joint disease.
3. be able to characterize traumatic lesions and identify signs of instability.
4. be able to identify spinal cord compression and the cause for the compression (e.g. neoplastic involvement of the vertebral body, infection, and trauma).
5. Learn the imaging features that allow for spatial classification of spinal lesions (extradural, intra-dural extra-medullary, and intra-medullary).
6. Learn the differential diagnosis for pathology in each of the intra-spinal spaces
Become proficient at the identification of common lesions of the orbit, petrous bones, skull base and soft tissues of the neck.
Be able to identify and characterize common inflammatory processes in the paranasal sinuses

and mastoid bones.

Identify and classify traumatic lesions of the facial bones, petrous bones and orbits using established classification nomenclature.

Identify common inflammatory and neoplastic mass lesions of the soft tissues of the neck and have knowledge of criteria for identification and differentiation of causes of cervical adenopathy.

Patient Care, Interpersonal and Communication Skills, Practice Based Learning and Improvement

Learn to obtain informed consent for invasive procedures, including myelography, angiography and image guided biopsies. The resident should understand and be able to explain the risks, benefits and complications of these procedures to patients and their families.

Learn to perform fluoroscopically guided punctures of the lumbar spinal canal for the purpose of myelography, spinal fluid collection, and intrathecal injection of medications.

Assist attending radiologists in the performance of angiograms, myelograms, and biopsies.

Patient Care, Interpersonal and Communication Skills, Professionalism

Protocol and monitor CT studies. Be able to modify imaging protocols based on identification of unexpected or novel findings.

Act as a consultant for house staff and attending physicians in the Emergency department.

Provide emergent provisional interpretations of plain radiographs, CT scans and MR scans as needed.

Direct the choice of imaging modality and protocol emergent studies.

Be able to identify those cases that require urgent additional faculty expertise in assessment of imaging studies.

Third Rotations

Medical Knowledge, Interpersonal and Communication Skills, Practice Based Learning and Improvement, System Based Practice

Continue to expand knowledge of the anatomy and functional connections of the brain and spine begun during the first two rotations on the service.

Develop more detailed understanding of the basic pathology and pathophysiology of diseases of the brain, spine, and head & neck including neoplastic, vascular, and inflammatory lesions.

Expand and apply knowledge base in emergent neuroradiologic studies, including triage and protocols for patients with acute ischemic stroke, hemorrhage, and trauma.

Study extracranial and intracranial vascular anatomy and its pathophysiology using CT, MRA, catheter angiography, and ultrasound. Be familiar with strengths and weaknesses of these techniques for common imaging indications, and pitfalls in image interpretation.

Learn patterns of pediatric and developmental neuropathology, including neuronal migration disorders, metabolic disease, and disorders of myelination.

Refine understanding of indications for direct coronal imaging, and orthogonal and 3D reconstructions.

Learn to prepare and present cases in clinical conferences for tumor board, teaching, and management.

Patient Care, Interpersonal and Communication Skills, Professionalism

Take increasing responsibility for obtaining informed consent for invasive procedures for including myelography, angiography and image guided biopsies. The resident must understand and be able to explain the risks, benefits and complications of these procedures to patients and their families.

Expand clinical consultation and technical experience for fluoroscopically guided punctures of the lumbar spinal canal for the purpose of myelography, spinal fluid collection, and intrathecal injection of medications.

Assist attendings in the performance of angiograms, myelograms, and biopsies, taking on an increasing role as appropriate.

Interpersonal and Communication Skills, Professionalism, Patient Care

Protocol and monitor CT and MRI studies. Learn to set up and refine imaging protocols in CT and MRI based on specific clinical indications. Be able to modify imaging protocols based on identification of unexpected or novel findings at the time of scanning.

Act as a consultant for house staff and attending physicians in the Emergency Department.

Provide emergent provisional interpretations of plain radiographs, CT scans and MR scans as needed.

Direct the choice of imaging modality and protocol emergent studies.

Identify those cases that require the urgent additional expertise of faculty radiologists in assessment of imaging studies.

Fourth Rotation

Goals

Medical Knowledge, Interpersonal and Communication Skills, Professionalism, System Based Practice

Become proficient at the interpretation of CT and MR scans.

Develop the ability to accurately describe complex findings and generate comprehensive yet precise differential diagnoses of a variety of common and uncommon lesions of the brain, skull, and spine.

Learn the imaging features of post-operative and post-radiation exams.

There should be a special emphasis on acquiring basic knowledge and experience in the interpretation of imaging studies of diseases of the orbits, petrous bones, skull base, and soft tissues of the neck.

Develop the ability to use neuroimaging studies to solve a broad range of clinical problems. Learn how to choose the appropriate study (e.g. CT vs. MR) and the appropriate protocol in a variety of clinical circumstances.

Increase proficiency with fluoroscopic guided spinal punctures and image-guided biopsies of the spine. Gain experience in the performance and interpretation of cerebral angiography and myelography.

Develop consultation skills.

Responsibilities

Patient Care, Interpersonal and Communication Skills, Professionalism Participate in the general performance of tasks within the section (e.g. contrast injection, patient monitoring) -see above

Interpret CT scans under the supervision of an attending at least twice a week.

Interpret MR scans at least three times a week under the supervision of an attending.

Provide emergent and/or provisional interpretations ("wet readings") for house staff and attending physicians. Monitor and protocol CT and MR exams.

Perform invasive procedures (spinal punctures, myelograms, CT guided biopsies and angiograms under the guidance of attending radiologists.

Neuroradiology Suggested Reading

General Texts

Diagnostic Neuroradiology - Anne G. Osborn, CV Mosby

Handbook of Head and Neck Imaging, - H. Ric Harnsberger, CV Mosby

MRI, the basics - Ray H. Hashemi and William G. Bradley, Williams and Wilkins

Reference Texts

Magnetic Resonance Imaging of the Brain and Spine - Scott W. Atlas, Lippincott (Companion CD available)

Head and Neck Imaging - Peter M. Som and Hugh D. Curtin, CV Mosby

Pediatric Neuroimaging - A. James Barkovich, Raven Press

Journals

American Journal of Neuroradiology (AJNR)

Radiology

American Journal of Roentgenology (AJR)

Neuroimaging Clinics of North America

NUCLEAR RADIOLOGY

Each resident will have one rotation/year at William Beaumont Army Medical Center Nuclear Medicine Department under the supervision of Dr. Albert Moreno and his staff. The residents will participate in the performance, interpretation, and consultation of all procedures performed during their rotations, including bone densitometry and nuclear cardiology. However, they should concentrate their studies on those aspects emphasized in the medical knowledge sections for each rotation.

ROTATION I

Medical Knowledge

At the end of the rotation, the resident should be able to:

Demonstrate a basic knowledge of the clinical indications, general procedures (including radiopharmaceutical and dose), and scintigraphic findings in:

- o pulmonary (emboli) ventilation and perfusion imaging,
- o liver/spleen imaging
- o bone scanning and densitometry
- o cerebral blood flow imaging – in brain death

Discuss the basic physical principles of nuclear medicine imaging and instrumentation.

Identify the isotopes (including physical and chemical properties) that are used routinely in the compounding of radiopharmaceuticals for nuclear radiology procedures.

Practice Based Learning and Improvement

At the end of the first rotation, the resident should be able to:

Recognize limitations in personal knowledge and skills, being careful to not make decisions beyond the level of personal competence.

Patient Care, Interpersonal and Communication Skills, Medical Knowledge, System Based Practice

At the end of the first rotation, the resident should be able to:

Review histories of patients to be imaged each day to determine the relevance of the study to clinical symptoms, to evaluate for contraindications to the study, and to advise technologists about special views or specific parameters of the study that require special attention.

Assist technologists in the determination of the radiopharmaceutical dosage when patient conditions do not fit the criteria of the standard dose.

Observe the performance of at least one of each of the different scans routinely performed, as well as all the infrequently ordered studies.

Make a preliminary review of the images and advise technologists when additional views or repeat views are needed accordingly.

Rotation II

Medical Knowledge, Interpersonal and Communication Skills, Professionalism

At the end of the second rotation, the resident should be able to

Demonstrate a more thorough knowledge of the clinical indications, general procedures (including radiopharmaceutical and dose) and scintigraphic findings in:

- o renal and urinary tract studies
- o GI tract imaging and functional studies
- o thyroid imaging and functional studies
- o brain imaging and functional studies
- o tumor and abscess imaging
- o bone imaging and densitometry

Identify and discuss indications for isotopes used for therapeutic purposes

Describe the protocol for using I-131 for treatment of hyperthyroidism and thyroid malignancies, including protocol for hospitalization and monitoring of patients who receive over 30 mCi of activity.

Interpersonal and Communication Skills, Patient Care, Systems Based Practice, Professionalism, Medical Knowledge

At the end of the second rotation, the resident should be able to:

Interpret films with the assistance/review of the faculty radiologist.

Assist with radioactive therapy treatments, making sure the consent form is completed properly and that the appropriate dose is administered, giving particular attention to radiation safety practices during the procedure.

Assist with preparation/presentation of cases for resident film review.

Practice Based Learning and Improvement, Interpersonal and Communication Skills, Professionalism

At the end of the second rotation, resident should be able to:

Recognize limitations in personal skill and knowledge, always making sure dictations and consultations, are checked, by the faculty radiologist.

Review all scans as they are performed for significant findings that require prompt attention, and make decisions in regard to notification of the referring physician if the faculty radiologist is not immediately available for consultation.

ROTATION III

Medical Knowledge, System Based Practice

At the end of the third rotation, the resident should be able to:

Discuss the following information regarding all radiopharmaceuticals used in nuclear radiology studies:

- o production of isotopes
- o physical properties of isotopes
- o general elution and quality control
- o compounding of radiopharmaceuticals
- o radiochemical quality control
- o bio-distribution and mechanisms of localization

Calculate patient doses, using information related to decay factors, volume concentration, and patient parameters.

Describe the procedures and rationale for instrument quality control in nuclear medicine.

Discuss rules and regulations that apply to the practice of nuclear radiology as outlined in 10CFR20 and other appropriate sources.

Describe the types of records that must be maintained in order to comply with federal/ state guidelines for radiation safety and radioisotope receipt/use/disposal.

Demonstrate an in-depth understanding of the physics of nuclear radiology.

Medical Knowledge, System Based Practice

At the end of the third rotation, the resident should be able to:

Compound radiopharmaceuticals from kits and do appropriate quality control procedures.

Elute a generator and do appropriate quality control procedures.

Calculate and draw up patient doses.

Demonstrate appropriate use of a survey meter to monitor radioactivity spills or other sources.

Perform a wipe test.

Perform quality control procedures on cameras, well/uptake probes, and dose calibrators.

Handle radioactive sources according to the established guidelines.

System Based Practice, Patient Care, Interpersonal and Communication Skills, Professionalism

At the end of the third rotation, the resident should be able to:

Carry out the practice of nuclear radiology with due regard to quality control, quality assurance, and radiation safety for the patient and personnel.

ROTATION IV

Medical knowledge, Interpersonal and Communication Skills

At the end of the fourth rotation, the resident should be able to

Demonstrate a thorough knowledge of the clinical indications, general procedures and findings in:

- o myocardial viability studies
- o myocardial infarct imaging
- o multi-gated acquisition perfusion imaging and function studies (rest and stress)

Describe the radiopharmaceuticals and collimators used in cardiac nuclear studies, including the methods of red blood cell labeling, patient dosages and physical properties of the isotopes.

Discuss patient conditions and patient monitoring requirements, particularly in relation to exercise and drug stress studies.

Process computer data obtained in each of the different cardiac studies.

Discuss the range of invasive and noninvasive tests, test characteristics and the prognostic value of tests used to evaluate cardiac disease.

Medical Knowledge, Interpersonal and Communication Skills, System Based Practice

At the end of the fourth rotation, the resident should be able to:

Select tests for evaluation of cardiac disease on the basis of patient condition and clinical symptoms.

Correlate the results from various tests with interpretation of nuclear cardiology exams

PHYSICS AND RADIOPHARMACY (incorporated into each rotation)

Medical Knowledge, System Based Practice

Provisions will be made throughout the rotations to:

Discuss the following information regarding all radiopharmaceuticals used in nuclear radiology studies:

- o production of radionuclides
- o physical properties of radionuclides
- o generator elution and quality control of eluate
- o compounding of radiopharmaceuticals
- o quality control of radiopharmaceuticals
- o biodistribution and mechanisms of localization

Calculate patient doses, using information related to decay factors, volume concentration, and patient parameters.

Describe the rationale and procedures for instrument quality control in nuclear medicine.

Nuclear Radiology Suggested Reading Texts:

1. Nuclear Medicine Diagnosis and Therapy. Harbert. Thieme. 1996.
2. Nuclear Medicine. Henkin. Mosby. 2006.
3. Nuclear Medicine in Clinical Diagnosis and Treatment. Murray. Churchill Livingstone. 1994
4. Clinical Nuclear Cardiology: State of the Art and Future Directions. Zaret. Elsevier. 2004
5. Nuclear Cardiology. Heller. McGraw-Hill. 2003
6. Nuclear Cardiac Imaging. Iskandrian. Oxford. 2003
7. Nuclear Cardiology and Correlative Imaging. Delbeke. 2004. Springer-Verlag

8. Pulmonary Nuclear Medicine. Atkins. Marcel Dekker. 2001
9. Nuclear Oncology: Diagnosis and Therapy. Khalkhali. 2000. Lippincott Williams & Wilkins
10. Orthopedic Nuclear Medicine. Elgazzar. Springer-Verlag. 2004
11. Pediatric Nuclear Medicine/PET. Treves. Springer-Verlag. 2006
12. Pediatric Nuclear Imaging. Miller. Elsevier. 1994
13. Atlas of Nuclear Medicine in Sports Medicine. Cooper. McGraw-Hill. 2003
14. Atlas of Clinical Positron Emission Tomography. Barrington. Oxford. 2005
15. Clinical Atlas of PET. Kipper. Saunders. 2004
16. PET and PET/CT. Abass Alavi. Thieme. 2005
17. Teaching Atlas of Nuclear Medicine. Donohoe. Thieme. 2000.
18. Atlas of Nuclear Medicine. Coel. Saunders. 1996
19. Nuclear Medicine in the Management of Inflammatory and Infectious Diseases: When and How. Signore. Springer-Verlag. 2003
20. Functional cerebral SPECT and PET Imaging. Van Heertum. Lippincott Williams & Wilkins. 2000
21. Nuclear Medicine in Psychiatry. Otte. Springer-Verlag. 2004

Nuclear Radiology Suggested Reading Journals:

1. Journal of Nuclear Medicine
2. European Journal of Nuclear Medicine and Molecular Imaging
3. Journal of Nuclear Cardiology
4. World Journal of Nuclear Medicine
5. Clinical Nuclear Medicine
6. Nuclear Medicine Communications
7. Seminars in Nuclear Medicine
8. Quarterly Journal of Nuclear Medicine
9. Yearbook of Nuclear Medicine. Elsevier.
10. Nuclear Medicine Annual. Lippincott Williams & Wilkins

PEDIATRIC

Goals

Residents will rotate through the section of pediatric imaging for 4 one-month blocks during their four years of training. The experience includes exposure to conventional imaging, GI and GU fluoroscopic procedures, body and musculoskeletal CT and MR, as well as all ultrasound procedures on children.

Over this time, it is expected that each resident will progressively develop the ability to perform, interpret, and report results of imaging studies of children. Residents will be taught the practical skills needed to supervise, perform, interpret, and report fluoroscopic procedures and ultrasound examinations, to supervise, interpret, and report conventional images and body CT scans in children.

What is taught and applied in the pediatric imaging section will complement and be supplemented by what is taught in the other rotations that the residents experience.

Competencies and expectations are tailored to the residents' level of expertise, usually related generally to his/her level of training.

Objectives

Patient Care, Practice Based Learning and Improvement

Provide pediatric imaging patient care through safe, efficient, appropriately utilized, and quality-controlled diagnostic imaging techniques.

Accurately interpret procedure findings.

Effectively communicate with the referring practitioner in a timely manner. This includes evaluating exam requests and relaying results (see communication skills below).

Learn to prioritize urgent work.

Determine and describe appropriate procedures for investigation of a child with symptoms or signs of disease or congenital anomalies including:

Normal/abnormal airways and respiratory tract abnormalities on a chest x-rays of children of all ages.

Abnormalities associated with congenital heart disease on the chest radiographs of children of all ages.

Identify and describe normal and abnormal skeletal structures, with special attention to extremity and skeletal findings in trauma (including child abuse), neoplastic disease, bone dysplasias, hematologic and metabolic disorders, bone age, and congenital/acquired scoliosis.

Perform and interpret appropriate fluoroscopic examinations. Identify and describe normal and abnormal gastrointestinal tract, and genitourinary tract in fluoroscopic examinations including single and double contrast upper GI, single and double contrast lower GI, pharyngogram, pH probe placement, VCUG, feeding tube evaluation and placement or replacement (except interventional procedures), and other "sinogram" studies on children of all ages utilizing low dose radiation exposure techniques.

Determine, describe, and define techniques and protocols for CT scan. Identify and describe normal and abnormal chest, abdomen and pelvis findings in disease or congenital anomalies of children of all ages by CT scan.

Determine, describe, review and assess, and perform when needed, pediatric ultrasound examinations of the brain, spine, general abdomen, pylorus, kidneys, pelvis, scrotum, hips, superficial lesions, and vascular lesions on children of all ages.

Medical Knowledge (see also patient care above):

Continuously learn about the diseases, especially related to imaging findings and procedures using current evidence. Apply appropriate diagnostic techniques to meet the imaging needs of the patients, referring practitioners, and health care system (see systems practice below). Information, feedback, and guidance is available from the pediatric imaging attendings and other clinicians. Books are available in the pediatric radiology section and in the department and hospital libraries; journals are available in libraries or web-based. Self instructional material is also available on the internet. *This standard does not vary during the training.*

Practice Based Learning and Improvement

Self assessment and review with pediatric imagers regarding technique and reports. Be able to ask for and accept help.

Other radiology issues include coordinating multiple studies for one patient related to the timing and sequence of the studies, sharing of vascular contrast in multi-level examinations, timing of sedation.

Safety issues include: radiation doses, IV contrast, allergies and latex precautions, respiratory stability, dangers of aspirated contrast, leaked contrast, and hypertonic intestinal contrasts of diatrizoate meglumine with diatrizoate sodium ("Gastrografin").

Interpersonal & Communication Skills (see also patient care above):

Produce concise, yet thorough and grammatically correct, dictated reports on studies reviewed.

Effectively and appropriately communicate with patients, families, technical and clerical staff, other radiologists, clinicians concerning appropriateness of requested studies, consent if needed, safety issues, and results.

Improvement is through monitoring practice based learning (above). Be able to ask for and accept help.

Professionalism

Commit to high standards of professional conduct; demonstrate altruism, compassion, honesty, and integrity. Follow principles of ethics and confidentiality. Consider age, religious, ethnic, gender, educational, and other differences in interacting with patients and their parents or other caretakers and with other members of the health care team. The resident should maintain a personal appearance appropriate for a pediatric care physician. *This standard does not vary by level of training.*

Systems Based Practice

Understand how the components of the local and national healthcare system function interdependently and how changes to improve the system involve group and individual efforts.

Optimize coordination of patient care both within one's own practice and within the healthcare system. Consult with other healthcare professionals, and educate healthcare consumers, regarding the most appropriate utilization of imaging resources.

Expected competence by level of training

A resident should not limit involvement to only a specific level of training, but should seek to learn from all exceptional cases that are available.

First rotation emphasis:

Patient Care 1

In general, any resident whose first radiology rotation is in the pediatric section will need to learn the mechanics of dictation, the use of the fluoroscope, and basic radiographic interpretation principles.

Interpersonal & Communication Skills 1

All first rotation residents should concentrate on interpreting conventional images of chest, abdomen, and extremities and performing and interpreting common and uncomplicated fluoroscopic studies: upper GI, single contrast lower GI, pharyngogram, VCUG. This will include studies from the ED and from the pediatric and neonatal intensive care units.

The resident should interact professionally and pleasantly with patients, families, technical and clerical staff, other radiologists, including explaining examinations and results to families, sharing results with other clinicians

Practice Based Learning and Improvement 1

The resident should be able to learn from attending radiologists, more senior residents, and experienced technologists.

The resident will receive extensive support and feedback.

The resident will be expected to recognize difficulties and to appropriately request help in planning, performing, and interpreting studies.

The resident should practice basic safety practices in the immobilization of patients. The patient should not be able to fall and should be protected from loose needles and other dangerous objects.

The resident should seek to gain the most information with the least radiation. Low or no radiation examinations should be considered before high dose examinations.

Consider risk of renal damage from iodine based vascular contrast.

Learn the relative dangers of barium vs. water-soluble contrast material in various body cavities.

Be aware that intestinal contrast agents, such as diatrizoate meglumine with diatrizoate sodium ("Gastrografin") are hypertonic and there are potential consequences.

Systems Based Practice 1

Try to be aware of the need for coordination of patient care studies.

Second Rotation General Competencies

Patient Care , Practice Based Learning and Improvement

Residents should update the fluoroscopic skills previously learned; this will be particularly important in those residents whose initial pediatric imaging rotations were early in the residency.

Thereafter, the resident should be able to perform the basic procedures with less direction from an attending, and should seek to learn studies with more potential for complications such as intussusception reduction and tube placements.

Residents should become able to guide the technicians in procedure organization and to prioritize pending studies by urgency.

The resident should participate more in review of Neonatal ICU radiographs.

By the second rotation, residents will generally have experience in adult CT and ultrasound and should add those modalities to the first rotation skills.

In addition to general pediatric chest, abdomen, and pelvis CT, the resident should seek to learn how to coordinate studies involving multiple body parts (e.g. body with neuro imaging or with musculoskeletal, or CT with nuclear medicine or MRI), and to coordinate patients requiring sedation.

In addition to understanding how pediatric ultrasound studies differ from adult ones, the resident will participate in ultrasound studies of hips, spine, pylorus, and brain in infants.

Nonetheless, a resident should not limit involvement to only these more complex studies but should seek to reinforce previously learned material and to share unusual cases with other imaging residents including those with less training.

Interpersonal & Communication Skills 2:

By the second rotation, but resident should be better able to give initial urgent preliminary readings and to work with the referring physician, evaluating the requests made by referring physicians, and explaining results.

The second rotation resident should be able to demonstrate imaging basics to medical students and pediatric residents.

Systems Based Practice 2

By the second rotation, residents will generally have experience in multiple modalities, and should be able to start to optimize coordination of patient care, to consult with other healthcare professionals, and to educate healthcare consumers regarding the most appropriate utilization of imaging resources.

Third and Fourth Rotations

More experience in all of the above.

The third and fourth rotation resident should be able to

- Prioritize by urgency

- Become more familiar and comfortable with special ultrasound procedures such as hip ultrasound, brain ultrasound, and pyloric stenosis evaluation.

- Have exposure to the spectrum of pediatric imaging including pediatric plain films, fluoroscopy, ultrasound, body and musculoskeletal CT and MRI.

- Provide a thorough pertinent differential diagnosis of disease processes identified on imaging examination.

- Further build upon existing interpretation skills.

- Further hone skills with pediatric GI and GU fluoroscopic procedures, ultrasound procedures, and in prescribing protocols for performing and interpreting pediatric body CT and MRI evaluations.

- Enhance reporting skills, encouraging brevity without loss of clarity or completeness.

- To accept the graded responsibility provided, including providing substantially help to technicians and more junior residents.

References:

Donnelly et al: Diagnostic Imaging, Pediatrics. Saunders 2006.

Kuhn et al: Caffey's Pediatric Diagnostic Imaging, 10th Edition. Mosby 2005

Hilton and Edwards: Practical Pediatric Radiology, 3rd Edition. Saunders 2006

PHYSICS OF MEDICAL IMAGING

This course provides residents with comprehensive instruction in the basic physical processes and technology of the various methods of medical imaging. The modalities covered include: Conventional screen-film radiology, conventional tomography, mammography, fluoroscopy, digital radiography, computed tomography, ultrasound, magnetic resonance imaging, and nuclear medicine. Basic physical principles include: Radiation and atomic physics, interaction of radiation with matter, x-ray production, computer technology, image quality, radioactivity, radiation detection, nuclear magnetic resonance, radiation biology, and radiation protection.

Conferences

The primary course consists of approximately 23 one-hour lectures that survey all of the topics listed above and provide exposure to the kinds of problems encountered on the written boards. This course is given annually during the winter/spring. In preparation for the ABR written boards in September, approximately nine, two-hour weekly focused review sessions are offered every summer. The review course emphasizes problem solving.

Goal

Medical Knowledge

Understanding of the basic physics and technology related to the nature and production of radiation and its interactions with matter.

Knowledge Based Objectives

- At the completion of the course, the resident will demonstrate knowledge of:
 - Nature of electromagnetic radiation including x-rays and gamma rays.
 - Structure of the atom: its nucleus and electron cloud.
 - Interaction of radiation with matter.
 - X-ray production, x-ray tubes and generators.

Suggested Reading and Study Materials

- The Essential Physics of Medical Imaging, *2nd Edition* by JT Bushberg et al.
- Review of Medical Physics by W Huda
- Christensen's Physics of Diagnostic Radiology, *4th Edition*, T. S. Curry et al.
- Course class notes

Goal

Understanding of the nature and components of image quality and the physics and technology of fundamental imaging techniques (not requiring computer assistance).

Knowledge Based Objectives

Medical Knowledge

- Image Quality
- Screen Film Radiography
 - o Film
 - o Screen- Film systems
 - o Film Processing and QA
 - o Geometrical considerations in imaging
 - o Conventional tomography and chest radiography
- Mammography
- Fluoroscopy

Suggested Reading and Study Materials

Course Class notes

The Essential Physics of Medical Imaging, *2nd Edition* by JT Bushberg et al.

Review of Medical Physics by W Huda

Goal

Understanding of the physics and technology of the more technically sophisticated methods of medical imaging evolved over the last 40 years (requiring computer assistance).

Knowledge Based Objectives

Medical Knowledge

Computers in Medical Imaging

Digital Radiography

Digital Subtraction Angiography

Computed Tomography

Ultrasound Imaging

Nuclear Medicine Imaging

- o Radioactivity and Nuclear Transformation
- o Radionuclide production and radiopharmaceuticals
- o Radiation detection and measurement
- o Nuclear imaging methods
- o Molecular biology

Suggested Reading and Study Materials

Course class notes

The Essential Physics of Medical Imaging, *2nd Edition*

by JT Bushberg, et al.

Review of Medical Physics by W Huda

Nuclear Medicine Physics - the basics, *5th Edition* by R Chandra

Diagnostic Ultrasound, Principles and Instruments, 5th Edition, by F. W. Kremkau

Goal

Understanding of radiation safety, dosimetry, and radiation biology

Understanding the principles and technology of Nuclear Magnetic Resonance and Magnetic Resonance Imaging.

Knowledge Based Objectives

Medical Knowledge

Radiation protection

Radiation dosimetry

Radiation biology

Basics physics of NMR

MR imaging pulse sequences

MR image formation

Parameters that affect MR imaging time and SNR

MR imaging options

MR imaging artifacts

MR angiography

Suggested Reading and Study Materials

Course class notes

The Essential Physics of Medical Imaging, *2nd Edition*

by JT Bushberg et al.

Review of Medical Physics by W Huda

MRI the Basics by R Hashemi & W Bradley
A Non-Mathematic Approach to Basic MRI by H-J Smith & F Ranallo
Questions and Answers in Magnetic Resonance Imaging, by A. D. Elster

ULTRASOUND

Each resident will have 4 one-month rotations through ultrasound. In addition to observing, interpreting, and providing consultation on procedures, each resident is expected to gain proficiency in performing US examinations. The resident will keep a log of those examinations performed and review the log with the attending radiologist upon the completion of each rotation. Residents are expected to perform at least 200 ultrasound examinations during their residency.

Rotation I

Medical Knowledge, Practice Based Learning and Improvement, Patient Care,

At the end of the rotation, the resident should be able to:

Discuss the ultrasound procedures and findings in
gallbladder/biliary tree ultrasound

- cholelithiasis
- cholecystitis
- renal ultrasound
 - obstruction
 - renal failure
- duplex Doppler
- venous thrombosis of extremities

Understand anatomic relationships and be able to individually image intra-abdominal organs-liver, spleen, kidneys, gallbladder, biliary tree, aorta, IVC.

Be familiar with common intra-abdominal pathology.

Understand basic ultrasound physics and its clinical applications.

Demonstrate ability to turn on a machine, select the appropriate exam program and transducer, enter patient data and annotate images.

Understand basic doppler and vascular principles to interpret extremity DVT studies and flow (i.e. portal vein thrombosis).

Identify and localize fluid collections in the chest, abdomen and pelvis for aspiration.

System Based Practice

Learn basic US triage – which exams should be performed by US, and which by another modality, i.e. MRI, CT.

Technical and Performance Skills

Medical Knowledge, Patient Care, Interpersonal and Communication Skills

At the end of the rotation, the resident should be able to

Perform basic abdominal ultrasound.

Advise the sonographer about special views or specific parameters of the study that require special attention.

Decision Making and Value Judgment Skills

Medical Knowledge, Interpersonal and Communication Skills, Patient Care, Professionalism

At the end of the rotation, the resident should be able to

Given an ultrasound case, make a preliminary review of the images and advise the sonographers when additional views or repeat views are needed.

Provide preliminary reports on routine abdomen/pelvis/extremity cases.

Recommended Reading List

- Diagnostic Ultrasound by Carol M Rumack
- o *Abdominal Ultrasound chapters*
- Ultrasound: The Requisites by Middleton
- Ultrasound Secrets by V Dogra, D Rubens

Rotation II

Behavioral Objectives

Medical Knowledge, Patient Care, Interpersonal and Communication Skills

Knowledge Based Objectives

At the end of the rotation, the resident should be able to:

Demonstrate thorough knowledge of the ultrasound procedure through performing or assisting the sonographer with performance of the following studies:

- liver/biliary tree
 - o biliary obstruction
 - o tumors
 - o transplant evaluation
- pancreas
 - o inflammatory processes
 - o tumors
- renal
 - o tumors
 - o inflammatory processes
- pelvis
 - o uterine leiomyoma
 - o ovarian neoplastic disease
 - o non-neoplastic disease
- small parts transducer scans
 - o thyroid, scrotal, etc.

Given appropriate sonograms, identify and discuss significant characteristics of the pathologies listed in #1 above.

Technical Skills

Interpersonal and Communication Skills, Patient Care, Professionalism

At the end of the rotation, the resident should be able to

- Review all scans as they are performed for significant findings that require prompt attention
- Assist with the preparation and presentation of cases for the ultrasound/imaging conference
- Discuss cases with the medical students on rotation in ultrasound during the reading session.
- Prepare cases for the monthly Quality Assurance (QA) and teaching file and present them at the Ultrasound Quality Assurance Conference
- Perform basic pelvic, scrotal, thyroid, and DVT (upper and lower extremity) exams.
- Assist in interventional procedures guided by ultrasound; demonstrating appropriate patient interaction and knowledge of safety precautions.

Decision Making and Value Judgment Skills

Patient Care, Professionalism, Interpersonal and Communication Skills

At the end of the rotation, the resident should be able to:

Make decisions in regard to notification of the referring physician, if the faculty radiologist is not available for consultation.

Recommended Reading List

Diagnostic Ultrasound by C Rumack
Small Parts chapter
Ultrasound: The Requisites by Middleton
Ultrasound Secrets by V Dogra, D Rubens
Vascular, Pelvic and Small Parts chapters
Ultrasound in OB & Gynecology by Callen

Rotation III

Behavioral Objectives

Knowledge Based Objectives

Medical Knowledge, Interpersonal and Communication Skills, Professionalism

At the end of the rotation, the resident should be able to:

Discuss all aspects of ultrasound imaging, including indications, pathology, and correlative studies used for each examination.

Discuss with medical students, anatomical findings, pathology and reasons for doing the study, answering any questions the students may pose.

Technical Skills

Patient Care, Medical Knowledge

At the end of the rotation, the resident should be able to

Become adept at performance of doppler examinations, including carotids, extremities, abdomen, renal and liver transplants.

Become proficient in endocavitary scanning (transvaginal, transrectal)

Demonstrate appropriate interactive skills with patients and staff.

Decision Making and Value Judgment Skills

Medical Knowledge, Patient Care, Interpersonal and Communication Skills, Professionalism, System Based Practice, Professionalism

At the end of the rotation, the resident should be able to

Evaluate and read-out all US exams performed on service – pre-dictate routine cases.

Make preliminary decisions on all matters of interpretation and consultation and recognize the need to obtain assistance in situations that require immediate expertise of the faculty radiologist.

Decide on the appropriateness of procedures

Schedule procedures

Perform interventional procedures guided by ultrasound.

Recommended Reading List

Diagnostic Ultrasound by C Rumack
Vascular Ultrasound by Zweibel, et al
Ultrasound in Obstetrics & Gynecology by Callen

Rotation IV

Behavioral Objectives

Medical Knowledge, Patient Care, Interpersonal and Communication Skills, Professionalism

Knowledge based objectives

At the end of the rotation, the resident should be able to:

Demonstrate ability to run the entire US service – QA all exams, supervise junior residents or medical students, sonographers; check exams for adequacy, appropriateness, add or subtract exams, etc.

Become familiar with specialty US exams; transcranial doppler, penile doppler, shunt and fistulae exams, intra-operative US, endoluminal (GI)US, and contrast US exams.

Demonstrate ability to interact appropriately with patients, staff, and referring physicians.

Technical Objectives

Medical Knowledge, Interpersonal and Communication Skills, Professionalism

At the end of the rotation, the resident should be able to

Refine all scanning skills to include some subspecialty exams.

Recommended Reading List

Review as needed:

Diagnostic Ultrasound by Rumack

Ultrasound in Obstetrics and Gynecology by Callen

Vascular Ultrasound by Zweibel

Ultrasound: The Requisites, by Middleton

Ultrasound Secrets by V Dogra, D Rubens

Specific articles as needed from Radiology, AJR, JUM pertinent to topics.

OBSTETRICAL AND PELVIC ULTRASOUND

Following the one month rotation in obstetrical and gynecological ultrasound, the resident should understand and be able to discuss:

Technical and Performance Skills

Medical Knowledge, Patient Care, Interpersonal and Communication Skills, Professionalism

Basic physical principles of medical ultrasound:

1. Relevant principles of acoustics, attenuation, absorption, reflection and speed of ultrasound;
2. Biological, thermal and non-thermal effects of pulsed and continuous wave ultrasound beams;
3. Basic operating principles of ultrasound equipment, Doppler and color Doppler imaging and signal processing;
4. How to interpret and avoid artifacts;
5. The principles of measuring, storage and analysis of the ultrasound and Doppler data;

Behavioral Objectives

Medical Knowledge, Interpersonal and Communication Skills

Gynecology and Human Reproduction:

1. Normal pelvic anatomy: a) *Uterus* (size, position, shape; cyclical morphological changes of the endometrium; measurement of the endometrial thickness); b) *Ovaries* (size, position, measurement; cyclical morphological changes; assessment of the size and growth of the follicles, detection of ovulation); c) evaluation of the retrouterine space.
2. Gynecological abnormalities of the: a) *Uterus* (fibroids, adenomyosis, endometrial hyperplasia, polyps, endometrial carcinoma, location of intrauterine contraceptive devices); b) *Ovaries* (cysts, endometriosis, differential diagnosis of pelvic masses, benign and malignant tumors, ovarian carcinoma); c) *Tubes* (hydrosalpinx, and tumors of the Fallopian tube);
3. Infertility (monitoring of the follicular development in spontaneous and stimulated cycles, detection of ovarian hyperstimulation syndrome, diagnosis of ovarian (polycystic ovaries), uterine (uterine anomalies and abnormalities) and tubal (hydrosalpinx) causes of infertility; know how to perform hystero-contrast-sono-salpingography);

4. The resident should be able to identify emergency gynecological problems by transvaginal and transabdominal ultrasound (differential diagnosis of acute abdomen, detection of the different sites of ectopic pregnancy),
5. To apply Doppler and color Doppler ultrasound in oncologic cases.
6. To interact effectively with patients and staff in a professional, safe, and compassionate manner.

Obstetrics:

1. Investigation of early pregnancy (measurement of the gestational sac, yolk sac, embryonic pole, crown-rump length of the fetus, detection of multiple pregnancy and evaluation of the chorionicity and amnionicity);
2. Evaluation of the fetal anatomy and embryonic-fetal biometry;
3. Detection of fetal viability;
4. Measurement of the nuchal translucency, detection of cystic hygroma;
5. Ultrasound features of early pregnancy failure, threatened abortion, missed abortion, anembryonic pregnancy, and chorionic trophoblastic disease (e.g. hydatidiform mole);
6. Ultrasound features of different sites of ectopic pregnancy; correlation of the biochemical and ultrasound data;
7. Assessment of the amniotic fluid (estimation of the amniotic fluid volume), umbilical cord (number of cord vessels, presence of the cysts, coiling) and placenta (location and morphology); evaluation of the cervix (length, shape);
8. Assessment of the fetal anatomy at 18 to 22 weeks (shape of the skull, assessment of the face and profile, brain structures – cerebral ventricles, cisterna magna, choroid plexus; longitudinal and transverse assessment of the fetal spine; evaluation of the head size and position, heart rate and rhythm, four chamber view; outflow tract; thorax (size and morphology of fetal lungs) and abdomen (with emphasis to outer shape and continuity of the abdominal wall); abdomen: visualization of the stomach, liver, kidneys, urinary bladder and umbilicus; limbs: femur, tibia, humerus, radius, ulna, hands, and feet, evaluation of bone echogenicity, shape and movement of the extremities);
9. Detection, evaluation, differential diagnosis, epidemiology and natural history of structural and functional fetal anomalies of the – skeletal system, central nervous system, cardiovascular system, anomalies of the intrathoracic cavity, renal and gastrointestinal system, abdominal wall and diaphragm.
10. Detection of the ultrasound markers of chromosomal abnormalities;
11. Detection of the functional abnormalities, such as amniotic fluid abnormalities (polyhydramnios, oligohydramnios, fetal hydrops)
12. Perform fetal biometry (assessment of the fetal size, including biparietal diameter, head circumference, abdominal circumference, and femur length);
13. Perform the measurements of the central nervous system to diagnose cranial anomalies; anterior/posterior horn of the lateral ventricle, transcerebellar diameter;
14. Estimation of the gestational age;
15. Assessment of the fetal growth and fetal weight estimation;
16. Perform and interpret biophysical profile; analysis of fetal body movements, fetal breathing, heart rate and rhythm, eye movements, breathing movements;
17. Use Doppler for assessment of the blood flow velocity measurements and waveform analysis of normal and complicated pregnancies (e.g. intrauterine growth retardation);
18. Clinical implications of Doppler studies in monitoring rhesus iso-immunization and diabetic pregnancy; detection and follow-up of twin-to-twin transfusion syndrome.

Decision Making and Value Judgment Skills

Medical Knowledge, Patient Care, Interpersonal and Communication Skills, Professionalism

Medico-legal implications, bioethical principles and patient information confidentiality

VASCULAR and INTERVENTIONAL RADIOLOGY

Throughout the four-year residency in Diagnostic Radiology Residency, each resident completes six one-month rotations in Vascular and Interventional Radiology. The ensuing outline will detail the goals and objectives for each one-month rotation on the service.

First Rotation

Goals

Medical Knowledge, Practice Based Learning and Improvement

Demonstrate the ability to obtain an informed consent.

Demonstrate the ability to obtain pertinent patient information from the **PACS** system and the patient chart prior to the performance of an invasive procedure.

Professionalism,

Demonstrate timeliness and responsible work ethic.

Patient Care, System Based Practice

Demonstrate the ability to monitor and follow patients assigned to him/her during the rotation and have at hand pertinent clinical information i.e. chest tube output, abscess tube output, findings from follow-up chest/abdomen/pelvic CT scans

Objectives

Medical Knowledge, Practice Based Learning and Improvement

Name the pertinent labs that must be known prior to performing an arteriogram, a biliary drainage, and a percutaneous nephrostomy or abscess drainage.

Describe the superficial and deep venous system of the upper and lower extremity.

Describe the arterial anatomy of the lower extremity, the pelvis, and the abdomen.

Name the indications for PICC line placement.

Second Rotation

Goals

Interpersonal and Communication Skills

Ability to dictate in a clear, succinct fashion on a timely basis.

Medical Knowledge, Practice Based Learning and Improvement, Patient Care

Knowledge of appropriate choice of antibiotics for bacterial coverage prior to percutaneous nephrostomy, biliary drainage, abscess drainage.

Demonstrate safety with sharps and timely removal of sharp objects from the tray and placement in the sharp's box.

Knowledge of deep venous disease including the indications for venography, duplex ultrasound, MR venography and therapeutic treatment options.

Knowledge of visceral arterial anatomy and common normal variants (i.e. replaced right hepatic artery, left gastric-left hepatic etc.).

Knowledge of function of pleurovac system and Heimlich Valve.

Objectives

Medical Knowledge, Practice Based Learning and Improvement

Name the arterial anatomy of the external and internal iliac arteries.

Name the venous anatomy of the chest, abdomen and pelvis; identify collateral pathway between the azygos system and svc and IVC.

Name and identify the renal arterial branches and describe Brödel's avascular zone and its relationship to percutaneous nephrostomy.

Describe the intrahepatic and extrahepatic biliary system and anatomy; describe the specific biliary complications that can result from laparoscopic gallbladder removal.

Describe the risk factors for pneumothorax secondary to percutaneous lung biopsy.

Describe the risk factors for hemoperitoneum secondary to liver biopsy.

Describe different types of aneurysms i.e. atherosclerotic, mycotic, post-traumatic and give an example of each.

Discuss when thrombolytics are helpful.

Discuss the indications for gastrostomy tube placement, gastrojejunostomy placement, and jejunostomy tube placement.

Third and Fourth Rotations

Goals

Medical Knowledge, Practice Based Learning and Improvement

Knowledge of peripheral vascular disease including risk factors, evolution of atherosclerotic plaques, site of plaque formation.

Knowledge of method for evaluating the patient with peripheral vascular disease from noninvasive to invasive modalities (history, physical, duplex sonography, MR angiography, diagnostic arteriography).

Knowledge of complications of diagnostic arteriography and methods of reducing the incidence of these complications and their management.

Knowledge of contrast agents: ionic agents, nonionic agents and indications for premedication prior to contrast administration as well as medical protocol.

Ability to recognize various contrast agent reaction and appropriate treatment regimens.

Medical Knowledge, Practice Based Learning and Improvement, Patient Care

Describe the various access routes for hemodialysis: Cimino-Brescia fistula, Bridge and Loop Gortex Dialysis Grafts, and dialysis catheters.

Describe when a temporary dialysis catheter is warranted and when a tunneled dialysis catheter is indicated; name access sites that appropriate for placement.

Name the central vein that is considered malpractice to place a temporary or tunneled dialysis catheter.

Describe when metallic stents would be indicated to preserve access for continued dialysis

Name risk factors for contrast induced nephrotoxicity.

Discuss when it is appropriate to remove an abscess tube; what factors must be known prior to removal and if imaging is needed.

Discuss the indications and contraindications for IVC Filter placement; describe the currently available FDA approved filters, its respective advantages and disadvantages.

Discuss the checklist to be assessed prior to proceeding with a pulmonary arteriogram.

Draw a left bundle block pattern, as it would appear on a 12 lead EKG. Define when a temporary pacer is required prior to pulmonary arteriography. Discuss the contraindications to pulmonary arteriography.

Discuss the advantages of tunneled catheters for therapy versus PICC lines versus Ports and discuss when each would be appropriate/ inappropriate.

Fifth and Sixth Rotations

Goals

Medical Knowledge, Practice Based Learning and Improvement

Knowledge of the mechanism of angioplasty

Knowledge of complications of angioplasty

Knowledge of indications for vascular stent placement
Knowledge of indications for renal angioplasty and stent placement
Knowledge of indications for biliary stent placement
Knowledge of indications and contraindications for TIPS placement
Knowledge of indications of gastrostomy tube placement
Knowledge of indications for radiofrequency ablation of masses.
Knowledge of indicative for vertebroplasty/kyphoplasty
Knowledge of venous ablations (laser radio frequency)

Objectives:

Medical Knowledge, Patient Care

Discuss various embolic agents that are clinically available i.e. liquids, particulates, coils; discuss when each type of agent is clinically indicated and contraindicated

Discuss the post-embolization syndrome

Discuss the arterial blood supply to the uterus and ovaries; what is the incidence of ovarian failure after uterine artery embolization

Discuss cholesterol embolization, its causes, and treatments (if any)

Discuss hypercoagulable states

Discuss heparin induced thrombocytopenia

Discuss anticoagulants (unfractionated heparin, low molecular weight heparin, coumadin) and where in the coagulation cascade each works; discuss antiplatelet agents (ReoPro, Aggrastat, integrelin, clopidogrel)

Discuss the types of portal hypertension (dynamic, presinusoidal, sinusoidal, postsinusoidal) and causes of each; discuss the hepatic venous anatomy and indications for free and wedged hepatic venous hemodynamic assessment.

Discuss the complications that can occur during tunneled dialysis catheter placement; specifically, discuss how to lessen the incidence of air embolism and treatment if this were to happen.

Discuss the dangers of local thrombolytic therapy and discuss compartment syndrome as it relates to reperfusion of a threatened ischemic extremity

Discuss when local thrombolytic treatment is contraindicated. Why is echocardiography a necessary test prior to initiating local thrombolytic therapy in acute ischemia secondary to embolic disease?

Discuss different sclerosing agents for lymphoceles or cysts.

Define pelvic congestion syndrome and how is it analogous to varicocele formation in the male and their treatment options.

TECHNICAL SKILLS THAT SHOULD BE MASTERED DURING THE FOUR MONTHS ON VASCULAR-INTERVENTIONAL RADIOLOGY:

First Rotation

Technical Skills

Patient Care

Performance of PICC line under fluoroscopic and ultrasound guidance.

Performance common femoral venous puncture.

Performance of a single wall puncture of common femoral artery.

Correct access site compression after arteriography.

Performance of image guided biopsy.

Second Rotation

Technical Skills

Patient Care

Manual dexterity in using pigtail catheter to go around the aortic bifurcation.

Manual dexterity using the Omni Selective, Cobra, and Sos Omni.

Basic skills in suturing; interrupted, running, and subcuticular suturing techniques; knows when to use absorbable and nonabsorbable suture.

Performance of ultrasound-guided puncture of the internal jugular vein.

Ability to perform a tunneled dialysis catheter placement in the internal jugular vein.

Third and Fourth Rotations

Technical Skills

Patient Care

Ability to place an IVC Filter.

Ability to safely reform a Simmons catheter and knows which one to use for the situation at hand.

Ability to perform pulmonary arteriography and knowledge of appropriate catheters use.

Ability to perform ultrasound guided percutaneous nephrostomy and biliary drainage.

Fifth and Sixth Rotations

Technical Skills

Patient Care

Ability to perform an antegrade femoral puncture.

Ability to perform graded ultrasonic compression to treat a puncture site pseudoaneurysm.

Ability to perform post-traumatic embolization of pelvic bleeders.

Ability to perform visceral arteriography.

Ability to perform lung biopsies and place Heimlich Valves for post lung biopsy pneumothorax.

Ability to perform cerebral and carotid angiography.

Fifth and Sixth Rotations

Goals

Medical Knowledge, Practice Based Learning and Improvement

Knowledge of the mechanism of angioplasty

Knowledge of complications of angioplasty

Knowledge of indications for vascular stent placement

Knowledge of indications for renal angioplasty and stent placement

Knowledge of indications for biliary stent placement

Knowledge of indications and contraindications for TIPS placement

Knowledge of indications of gastrostomy tube placement

Knowledge of indications for radiofrequency ablation of masses.

Knowledge of indications for vertebroplasty/kyphoplasty

Knowledge of venous ablations (laser radio frequency)

CONFERENCES

Resident education occurs through teaching at the workstation, conferences, courses and independent study.

Departmental

Two daily lectures or case conferences are given by faculty on Monday through Friday 12 noon – 1:00 pm and 4:00 pm – 5:00 pm. Grand Rounds, presented by a visiting professor, faculty, or resident, are held every third Thursdays from 4:00 – 5:00 pm. **Residents are required to give Grand Rounds once during their residency during their second year.** Resident attendance at these conferences is required, and reported with each resident's semi-annual performance evaluation. Each resident is responsible for arriving at conference on time. A monthly conference schedule is distributed to all residents and faculty.

Journal Club

Journal Club conference is held on a monthly basis and provides the resident an opportunity to discuss topics found in current peer-reviewed medical literature. Powerpoint presentations are required.

Interdepartmental Conferences

There are numerous interdepartmental conferences and work rounds. At these, cases of interest to the relevant service are discussed primarily from a clinical point of view, but with varying degrees of radiological relevance. Depending upon the clinical work situation, residents are encouraged to attend.

Core Curriculum Presentations

Presentations on core curriculum topics are provided by both the institution throughout the year, and as a joint effort by the American College of Radiology (ACR) and the Association of Program Directors in Radiology (APDR). The ACR/APDR curriculum consists of a series of videotaped lectures on noninterpretive issues that are shown to residents throughout the year. Topics include:

Job Search and Contracting Issues,

Practical Business Issues in Radiology,

Critical Thinking Skills,

Ethics,

ACR Standards, Accreditation Programs and Appropriateness Criteria,

Service Orientation/Interpersonal Skills, and

Medical Organizational Politics,

Other items considered to be part of the core curriculum are Professionalism, Resident Fatigue and Impairment, Competency and Education in Legal Medicine

RESOURCES

Departmental Library

In addition to the medical school library, there is a departmental library adjacent to the resident office suite. The reading room is stocked with books of interest to radiology. Periodicals and journals are also available through the chairman's office and other faculty.

Video presentations and the computerized teaching files will be available on the residents' computer located in the residents' office area along with CD ROM. The teaching files are an excellent teaching aid as one progresses through the residency; they are especially helpful in the resident's later years for general review. Additional teaching file materials and periodicals are available in many faculty offices.

Teaching file

Residents must place **two** cases into the teaching file annually to progress to the next year. These cases will be reviewed by the education committee and will be part of the resident's portfolio in the evaluation of core competencies.

RESIDENT DUTIES AND RESPONSIBILITIES

Night Call and Weekend Duties

Call responsibilities are divided into short and long call divisions. Call is taken in addition to the resident's primary rotation with appropriate time off post call to meet work hour guidelines.

Residents work day is from 8am to 5pm daily.

Resident call duties in house are every fourth night

- a. short night: 5pm to 10pm weeknights in house (with faculty or senior residents for first twelve months of residency)
- b. short weekend day: 8am-5pm (with faculty or senior resident for first twelve months of residency)
- c. long night: 5pm to 8am in house, alternating with short night

Faculty back up for diagnostic/trauma and interventional procedures

Faculty review of resident interpretations:

- a. 7am every day for overnight call
- b. ongoing during weekend day

Residents are encouraged to work as a team so that prompt accurate medical care is provided. These residents provide preliminary interpretation of conventional studies for both inpatients and emergency department patients and ensure that pertinent information is accurately and efficiently conveyed to the referring physicians. These residents are representatives of the department and are responsible for ensuring the smooth operation of our services while on their shift. These residents need to be available for consultation with emergency department staff and resident physicians to demonstrate radiology's commitment to attentive, responsive medical service.

With regards to all call, if ever a clinical problem arises with which the resident is uncomfortable in handling, there is always faculty on duty or on call for immediate assistance. Vascular-Interventional Radiology call is primarily delegated to the resident on that service.

The resident will be asked to make judgments as to whether imaging is indicated in a particular clinical setting, and if so, what sequence should be followed. Coordination with on-call technologists and physicians is necessary. It is expected that the resident will be able to expedite most problems. To do this effectively, the resident has to maintain a close liaison with clinical colleagues and be familiar with the patient.

On duty residents are responsible for reviewing examinations with radiology faculty at the 7am review time and before going off duty at the end of the day as appropriate. As in regular daily work, follow-up of interesting patients can be very educational.

Similar responsibilities apply to weekends and holidays. The resident who is to be relieved has an obligation to stay and continue to function until an orderly transition is possible. The incoming resident should receive a verbal/written sign out regarding any problems or scheduled examinations still to be performed.

The chief resident is in charge of resident daily schedules including conferences and handles on-call issues. Evening call rotation, weekends and holidays, are scheduled as evenly as possible, by the chief residents. Holiday coverage can usually be arranged so that no resident will be required to cover the same holiday more than once during a four-year period. All residents are expected to share call. Absence due to

illness or other emergencies will have to be “repaid” to the replacement resident. If there is variation from the printed monthly call schedule, the resident on duty is responsible to inform the hospital operator of the change.

Post Call Time Off

Residents are on call an average of every fourth night (including weekends). On call residents are off duty for 24 hours

- a. after each overnight call
- b. after one weekend day/week

Short call residents are off duty until 4pm conference the next day (18 hours)

Duty hours average 65hours/week over a 4 week period

Night Call Qualifying Examination

Before beginning long emergency radiology rotations, every resident must pass a Night Call Qualifying Examination. The initial exam is given in the Fall. If necessary, repeat examination is offered before the resident is allowed to proceed to long night duty rotations.

Vacations

Each resident is entitled to four calendar weeks (twenty weekdays) of vacation per year; these days must be used in the given academic year and do not roll-over. Leave request forms must be completed by the resident and signed by the appropriate section-chief prior to submission to the chief residents. No more than one week of vacation per 3-month service assignment is permitted. Approval for more than one consecutive week of vacation must be scheduled before the beginning of the year so that it can span two blocks (last week of one and first week of the other) and is *not* guaranteed.

Every effort is made to allow residents to obtain vacation when they wish, provided service assignments and night/weekend call can be adequately covered. Residents can expect to have *limited* vacation time available during July when fewer trained residents are on duty. Times of the major radiological meetings (RSNA, ARRS, AUR) and American Board of Radiology or in-service examination times are also not suitable for vacation.

Up to four academic days are allotted for job/fellowship interviews; any time away beyond four days is counted as vacation time. Please plan appropriately.

The proper procedure to request away time is:

Complete an away request

Obtain signature of the section chief for that rotation/time

Return the signed request to your Chief Resident to assure that night/weekend call is covered.

Once signed by the Chief Resident, the paperwork needs to be approved by the Program Director

RESIDENT EVALUATION PROCESS

Evaluation and Competency of Residents

Evaluation is primarily based on the resident's understanding of disease processes, anatomy, imaging and procedural skills, in keeping with the level of training.

Evaluation of the resident will include, but is not limited to, attendance, number and quality of reports, performance at image interpretation sessions, participation in conferences, observation of technical skills, and feedback from staff, and other residents.

Evaluations are based on the six competencies as required by the ACGME.

- Professionalism
- Medical Knowledge
- Patient Care
- Interpersonal and Communication Skills
- Practice-Based Learning and Improvements
- System-Based Practice

Residents are expected to participate in the 360 ° evaluation process via the currently used program. In this process, they are given the opportunity to evaluate other residents on their service.

APPENDIX 1

Resident Evaluation Forms

**TTUHSC-Paul L. Foster School of Medicine
Department of Radiology
EVALUATION OF COMPETENCE**

Interpersonal and Communication Skills

Resident: _____ PGY level: _____

Evaluator: _____

Rotation: _____ Dates: _____

Interpersonal and Communication Skills is defined by the ACGME as a competency in which the resident demonstrates skills that result in effective information exchange and teaming with patients, patients' families, and professional associates. As determined by the Association of Program Directors in Radiology (APDR) Education Committee, **Radiology residents are expected to:**

- Provide a clear and informative written radiologic report including a precise diagnosis whenever possible, a differential diagnosis when appropriate, and recommended follow-up or additional studies when appropriate
- Provide direct communication to the referring physician or appropriate clinical personnel when interpretation reveals an urgent or unexpected finding and document this communication in the radiologic report
- Demonstrate effective skills of face-to-face listening and speaking with physicians, patients, patients' families and support personnel
- Demonstrate appropriate telephone communication skills
- Demonstrate skills in obtaining informed consent, including effective communication to patients of the procedure, alternatives and possible complications

Instruction to the evaluator: Please use the key to evaluation categories to indicate, in the table below, the degree to which the named resident evidences achievement in the competency domain of Interpersonal and Communication Skills taking into consideration the resident's level of education and training.

Key to evaluation categories:

- 1 = performance below level expected for year in training
- 2 = performance at level expected for year in training
- 3 = performance above level expected for year in training
- 0 = not observed

Level of Performance Achieved	Interpersonal and Communication Skills Competency Components
	Writes radiologic reports that are clear and concise and which contain the necessary elements related to patients' diagnoses including recommendations for follow-up or additional studies as necessary
	Immediately contacts the referring physician or appropriate clinical personnel when circumstances dictate

	Engages in active listening when interacting with patients and patients' families and speaks to them in a manner that reflects cultural awareness
	Is able to sustain a good working relationship with other physicians and support personnel
	Speaks clearly and concisely when speaking to others via the telephone
	Appropriately obtains informed consent
	Clearly explains to patients what their procedure(s) involve(s)
	Provides effective instruction to medical students

Please check the source(s) by which your assessment of the resident's performance is derived:

- | | |
|--|---|
| <input type="checkbox"/> Direct observation | <input type="checkbox"/> Record review |
| <input type="checkbox"/> Chart simulation recall | <input type="checkbox"/> Procedure skills log |
| <input type="checkbox"/> Live/recorded performance | <input type="checkbox"/> Global rating |
| <input type="checkbox"/> Patient Survey results | <input type="checkbox"/> Examination |

For any area in which the resident received a score of "1", please provide an explanation highlighting what the resident can do to improve in the area of deficiency.

Component of competency in which a deficiency is noted: _____

Was the deficiency discussed with the resident at different times during the rotation? __Yes __No

Suggestions for Improvement:

**TTUHSC-Paul L. Foster School of Medicine
Department of Radiology
EVALUATION OF COMPETENCE**

Medical Knowledge

Resident: _____ PGY level: _____

Evaluator: _____

Rotation: _____ Dates: _____

Medical Knowledge is described by the ACGME as the ability to demonstrate an understanding of the scope of established and evolving biomedical and clinical sciences and the application of this information to patient care. As determined by the Association of Program Directors in Radiology (APDR) Education Committee, **Radiology residents** are expected to:

- Demonstrate sufficient knowledge of medicine and apply this knowledge to radiologic studies
- Demonstrate progressive acquisition of radiological knowledge
- Demonstrate knowledge of the principles of research design and implementation
- Generate a clinically appropriate diagnostic treatment plan
- Demonstrate the ability to use all relevant information resources to acquire evidence-based data
- Understand how radiologic equipment can be used to generate appropriate and diagnostic images

Instruction to the evaluator: Please use the key to evaluation categories to indicate, in the table below, the degree to which the named resident evidences achievement in the competency domain of Medical Knowledge taking into consideration the resident's level of education and training.

Key to evaluation categories:

- 1 = performance below level expected for year in training
- 2 = performance at level expected for year in training
- 3 = performance above level expected for year in training
- 4 = not observed

Level of Performance Achieved	Medical Knowledge Competency Components
	Recalls facts of structure, function, pathology, vocabulary for symptoms and signs relative to presented case
	Is able to interpret and critically appraise data to generate differential diagnoses for presented case
	Gives evidence of engaging in self-directed learning and is able to apply that learning to presented case in a systematic way
	Is able to synthesize information from different data sources and draw appropriate conclusions
	Is able to utilize the principles of research design and implementation

	Is able to clearly explain various radiologic procedures and how each is used to generate appropriate diagnoses
--	---

Please check the source(s) by which your assessment of the resident's performance is derived:

- | | |
|--|---|
| <input type="checkbox"/> Direct observation | <input type="checkbox"/> Record review |
| <input type="checkbox"/> Chart simulated recall | <input type="checkbox"/> Procedure skills log |
| <input type="checkbox"/> Live/recorded performance | <input type="checkbox"/> Global rating |
| <input type="checkbox"/> Patient Survey results | <input type="checkbox"/> Examination |

For any area in which the resident received a score of "1", please provide an explanation highlighting what the resident can do to improve in the area of deficiency.

Area of competency in which a deficiency is noted: _____

Was the deficiency discussed with the resident at different times during the rotation? __Yes __No

Suggestions for Improvement:

**TTUHSC-Paul L. Foster School of Medicine
Department of Radiology
EVALUATION OF COMPETENCE**

Patient Care

Resident: _____ PGY level: _____
 Evaluator: _____

Rotation: _____ Dates: _____

Patient Care is defined by the ACGME as the provision of care that is compassionate, appropriate and effective for the treatment of health problems and the promotion of health. As determined by the Association of Program Directors in Radiology (APDR) Education Committee, **Radiology residents are expected to:**

- Gather essential and accurate information about patients
- Develop a diagnostic plan based upon the clinical question(s) and relevant clinical, radiologic and pathologic information
- Oversee diagnostic imaging to ensure adequacy of studies performed
- Demonstrate the ability to use the Internet as an educational instrument to expand medical knowledge
- Demonstrate a basic understanding of electronic patient information systems
- Counsel patients concerning preparation for diagnostic testing
- Demonstrate knowledge of the levels of ionizing radiation related to specific imaging procedures and employ measures to minimize radiation dose to the patient
- Perform radiologic examinations appropriately and safely, assuring that the correct examination is ordered and performed

Instruction to the evaluator: Please use the [key to evaluation categories](#) to indicate, in the table below, the degree to which the named resident evidences achievement in the competency domain of Patient Care taking into consideration the resident's level of education and training.

Key to evaluation categories:

- 1 = performance below level expected for year in training
- 2 = performance at level expected for year in training
- 3 = performance above level expected for year in training
- 0 = not observed

Level of Performance Achieved	Patient Care Competency Components
	Gathers essential and accurate information about the patient
	Queries clinically inappropriate requests
	Counsels the patient in preparation for diagnostic testing
	Selects an appropriate management plan based on radiologic findings and clinical information

	Demonstrates proper technique in planning and performing image-guided procedures
	Ensures adequacy of diagnostic studies performed
	Applies safe radiation practice
	Demonstrates ability to utilize the PACS, EMR and Internet
	Handles transfer of care appropriately

Please check the source(s) by which your assessment of the resident's performance is derived:

- | | | | |
|--------------------------|---------------------------|--------------------------|----------------------|
| <input type="checkbox"/> | Direct observation | <input type="checkbox"/> | Record review |
| <input type="checkbox"/> | Chart simulated recall | <input type="checkbox"/> | Procedure skills log |
| <input type="checkbox"/> | Live/recorded performance | <input type="checkbox"/> | Global rating |
| <input type="checkbox"/> | Patient Survey results | <input type="checkbox"/> | Examination |

For any area in which the resident received a score of "1", please provide an explanation highlighting what the resident can do to improve in the area of deficiency.

Component of competency in which a deficiency is noted:

Was the deficiency discussed with the resident at different times during the rotation? _YES _NO

Suggestions for Improvement:

**TTUHSC-Paul L. Foster School of Medicine
Department of Radiology
EVALUATION OF COMPETENCE**

Practice-based Learning and Improvement

Resident: _____ PGY level: _____

Evaluator: _____

Rotation: _____ Dates: _____

Practice-based Learning and Improvement is defined by the ACGME as the ability of a resident to investigate and evaluate his/her patient care practices and appraise and assimilate scientific evidence in order to improve his/her practice. As determined by the Association of Program Directors in Radiology (APDR) Education Committee, **Radiology residents are expected to:**

- Analyze practice experience and perform practice-based improvement in cognitive knowledge and observational skills, formulating a synthesis and impression, and procedural skills
- Demonstrate critical assessment of the scientific literature
- Demonstrate knowledge of and apply the principles of evidence-based medicine in practice
- Use multiple sources, including information technology, to optimize life-long learning and support patient care decisions
- Facilitate the learning of students, peers and other health care professionals

Instruction to the evaluator: Please use the key to evaluation categories to indicate, in the table below, the degree to which the named resident evidences achievement in the competency domain of Practice-based learning and Improvement taking into consideration the resident's level of education and training.

Key to evaluation categories:

- 1 = performance below level expected for year in training
- 2 = performance at level expected for year in training
- 3 = performance above level expected for year in training
- 0 = not observed

Level of Performance Achievement	Practice-based Learning and Improvement Competency Components
	Demonstrates a desire to learn
	Critiques personal practice outcomes and makes efforts to recognize and correct personal errors
	Participates in quality improvement and quality assurance activities
	Utilizes library databases, internet and other information resources to support patient care decisions
	Adequately assesses research design and results in medical literature and their applicability to particular case presentations
	Seeks and responds to feedback
	Demonstrates awareness of strengths and limitations
	Provides appropriate instruction to medical students
	Establishes a learning plan and makes adjustments as necessary to achieve the goals and objectives of plan
	Possesses sufficient oral presentation skills

Please check the source(s) by which your assessment of the resident's performance is derived:

- | | |
|--|---|
| <input type="checkbox"/> Direct observation | <input type="checkbox"/> Record review |
| <input type="checkbox"/> Chart simulated recall | <input type="checkbox"/> Procedure Skills log |
| <input type="checkbox"/> Live/recorded performance | <input type="checkbox"/> Global rating |
| <input type="checkbox"/> Patient Survey results | <input type="checkbox"/> Examination |

For any area in which the resident received a score of “1”, please provide an explanation highlighting what the resident can do to improve in the area of deficiency.

Component of competency in which a deficiency is noted:

Was the deficiency discussed with the resident at different times during the rotation? Yes No

Suggestions for improvement:

**TTUHSC-Paul L. Foster School of Medicine
Department of Radiology
EVALUATION OF COMPETENCE**

Professionalism

Resident: _____
 Evaluator: _____
 Rotation: _____

PGY level: _____
 Dates: _____

Professionalism is defined by the ACGME as the demonstration of commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. As determined by the Association of Program Directors in Radiology (APDR) Education Committee, **Radiology residents are expected to:**

- Demonstrate altruism (putting the interests of patients and others above one's own self-interest)
- Demonstrate compassion: be understanding and respectful of patients, patients' families, staff and physicians caring for patients
- Demonstrate excellence: perform responsibilities at the highest level and continue active learning throughout one's career
- Be honest with patients and all members of the health care team
- Demonstrate honor and integrity: avoid conflicts of interest when accepting gifts from patients or vendors
- Interact with others without discriminating on the basis of religious, ethnic, sexual or educational differences and without employing sexual or other types of harassment
- Demonstrate knowledge of issues of impairment (i.e., physical, mental and alcohol and substance), obligations for impaired physician reporting, and resources and options for care of self impairment or impaired colleagues
- Demonstrate positive work habits, including punctuality and professional appearance
- Demonstrate an understanding of the broad principles of biomedical ethics
- Demonstrate principles of confidentiality with all information transmitted during a patient encounter
- Demonstrate knowledge of regulatory issues pertaining to the use of human subjects in clinical research

Instruction to the evaluator: Please use the key to evaluation categories to indicate, in the table below, the degree to which the named resident evidences achievement in the competency domain of Professionalism taking into consideration the resident's level of education and training.

Key to evaluation categories:

- 1 = performance below level expected for year in training
- 2 = performance at level expected for year in training
- 3 = performance above level expected for year in training
- 0 = not observed

Level of Performance Achieved	Professionalism Competency Components
	Is responsive to the needs of patients and advocates for their care in a manner that supercedes own self-interest
	Demonstrates awareness of diversity in the patient population and engages in speech and conduct which reflects that awareness
	Shows respect for patients' expectation of confidentiality
	Follows HIPAA regulations regarding the management of patients' health information
	Conducts self in an manner reflecting awareness and understanding of the ethical principles which guide the profession
	Acts to ensure the continuity of patient care
	Solicits and accepts feedback from other physicians and support personnel for performance improvement
	Accepts responsibility for errors
	Maintains appropriate boundaries in interactions with patients, patients' families, and other professional associates

	Maintains composure in a difficult situation
	Is punctual
	Completes assigned responsibilities in a timely and reliable fashion
	Maintains a professional appearance
	Demonstrates understanding of the issues pertaining to human research
	Shows awareness of the impact of impairment on personal health and patient care

Please check the source(s) by which your assessment of the resident's performance is derived:

- | | |
|--|---|
| <input type="checkbox"/> Direct observation | <input type="checkbox"/> Record review |
| <input type="checkbox"/> Chart simulated recall | <input type="checkbox"/> Procedure skills log |
| <input type="checkbox"/> Live/recorded performance | <input type="checkbox"/> Global rating |
| <input type="checkbox"/> Patient Survey results | <input type="checkbox"/> Examination |

For any area in which the resident received a score of "1", please provide an explanation highlighting what the resident can do to improve in the area of deficiency.

Component of competency in which a deficiency is noted:

Was the deficiency discussed with the resident at different time during the rotation? Yes No

Suggestions for improvement:

**TTUHSC-Paul L. Foster School of Medicine
Department of Radiology
EVALUATION OF COMPETENCE**

Professionalism

Resident: _____
 Evaluator: _____
 Rotation: _____

PGY level: _____
 Dates: _____

Professionalism is defined by the ACGME as the demonstration of commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. As determined by the Association of Program Directors in Radiology (APDR) Education Committee, **Radiology residents are expected to:**

- Demonstrate altruism (putting the interests of patients and others above one's own self-interest)
- Demonstrate compassion: be understanding and respectful of patients, patients' families, staff and physicians caring for patients
- Demonstrate excellence: perform responsibilities at the highest level and continue active learning throughout one's career
- Be honest with patients and all members of the health care team
- Demonstrate honor and integrity: avoid conflicts of interest when accepting gifts from patients or vendors
- Interact with others without discriminating on the basis of religious, ethnic, sexual or educational differences and without employing sexual or other types of harassment
- Demonstrate knowledge of issues of impairment (i.e., physical, mental and alcohol and substance), obligations for impaired physician reporting, and resources and options for care of self impairment or impaired colleagues
- Demonstrate positive work habits, including punctuality and professional appearance
- Demonstrate an understanding of the broad principles of biomedical ethics
- Demonstrate principles of confidentiality with all information transmitted during a patient encounter
- Demonstrate knowledge of regulatory issues pertaining to the use of human subjects in clinical research

Instruction to the evaluator: Please use the key to evaluation categories to indicate, in the table below, the degree to which the named resident evidences achievement in the competency domain of Professionalism taking into consideration the resident's level of education and training.

Key to evaluation categories:

- 1 = performance below level expected for year in training
- 2 = performance at level expected for year in training
- 3 = performance above level expected for year in training
- 0 = not observed

Level of Performance Achieved	Professionalism Competency Components
	Is responsive to the needs of patients and advocates for their care in a manner that supercedes own self-interest
	Demonstrates awareness of diversity in the patient population and engages in speech and conduct which reflects that awareness
	Shows respect for patients' expectation of confidentiality
	Follows HIPAA regulations regarding the management of patients' health information
	Conducts self in a manner reflecting awareness and understanding of the ethical principles which guide the profession
	Acts to ensure the continuity of patient care
	Solicits and accepts feedback from other physicians and support personnel for performance improvement
	Accepts responsibility for errors
	Maintains appropriate boundaries in interactions with patients, patients' families, and other

	professional associates
	Maintains composure in a difficult situation
	Is punctual
	Completes assigned responsibilities in a timely and reliable fashion
	Maintains a professional appearance
	Demonstrates understanding of the issues pertaining to human research
	Shows awareness of the impact of impairment on personal health and patient care

Please check the source(s) by which your assessment of the resident's performance is derived:

- | | |
|--|---|
| <input type="checkbox"/> Direct observation | <input type="checkbox"/> Record review |
| <input type="checkbox"/> Chart simulated recall | <input type="checkbox"/> Procedure skills log |
| <input type="checkbox"/> Live/recorded performance | <input type="checkbox"/> Global rating |
| <input type="checkbox"/> Patient Survey results | <input type="checkbox"/> Examination |

For any area in which the resident received a score of "1", please provide an explanation highlighting what the resident can do to improve in the area of deficiency.

Component of competency in which a deficiency is noted:

Was the deficiency discussed with the resident at different time during the rotation? Yes No

Suggestions for improvement:

**TTUHSC-Paul L. Foster School of Medicine
Department of Radiology
EVALUATION OF COMPETENCE**

Systems-based Practice

Resident: _____

PGY level: _____

Evaluator: _____

Rotation: _____

Dates: _____

System-based Practice is defined by the ACGME as the demonstration of an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. As determined by the Association of Program Directors in Radiology (APDR) Education Committee, **Radiology residents are expected to:**

- Demonstrate ability to design cost-effective care plans based on knowledge of best practices
- Demonstrate knowledge of the sources of financing for U.S. health care including Medicare, Medicaid, the Veteran's Administration, Department of Defense, public health systems, employer-based private health plans, and patients' own funds
- Demonstrate knowledge of basic health care reimbursement methods
- Demonstrate knowledge of the regulatory environment including state licensing authority, state and local public health rules and regulations, and regulatory agencies such as Centers for Medicare and Medicaid Services (CMS) and the Joint Commission of the Accreditation of Healthcare Organizations (JCAHO)
- Demonstrate knowledge of basic practice management principles such as budgeting, recordkeeping, medical records, and the recruitment, hiring, supervision and management of staff

Instruction to evaluator: Please use the key to evaluation categories to indicate, in the table below, the degree to which the named resident evidences achievement in the competency domain of Systems-based Practice taking into consideration the resident's level of education and training.

Key to evaluation categories:

- 1 = performance below level expected for year in training
- 2 = performance at level expected for year in training
- 3 = performance above level expected for year in training
- 0 = not observed

Level of Performance Achieved	Systems-based Practice Competency Components
	Utilizes knowledge of evidence based indications for imaging procedures to design cost-effective care plans
	Demonstrates familiarity with current American College of Radiology (ACR) Appropriateness Criteria
	Demonstrates familiarity with billing compliance practices
	Demonstrates knowledge of risk-benefit analysis
	Understands and applies knowledge related to reimbursement methods utilized by private, state and federal health plans
	Demonstrates an understanding of local population trends and resources
	Advocates for quality patient care and assists patients in dealing with system complexities
	Understands the reciprocal impact of personal professional practice, health care teams, and the health care organization on the community
	Participates in training related to establishing a medical practice

Please check the source(s) by which your assessment of the resident's performance is derived:

- | | |
|--|---|
| <input type="checkbox"/> Direct observation | <input type="checkbox"/> Record review |
| <input type="checkbox"/> Chart simulated recall | <input type="checkbox"/> Procedure skills log |
| <input type="checkbox"/> Live/recorded performance | <input type="checkbox"/> Global rating |
| <input type="checkbox"/> Patient Survey results | <input type="checkbox"/> Examination |

For any area in which the resident received a score of “1”, please provide an explanation highlighting what the resident can do to improve in the area of deficiency.

Competency component in which a deficiency is noted:

Was the deficiency discussed with the resident at different times during the rotation? __Yes __No

Suggestions for Improvement:

**TTUHSC-Paul L. Foster School of Medicine
Department of Radiology**

Referring Physician Survey

Resident: _____ PGY Level: _____

Your name: _____

Instructions: The following statements describe physician behaviors. Indicate how much you agree with the statements listed using the scale categories provided as applied to the resident named on this form. If you feel any item is NOT relevant to you, mark the item, "Unable to Assess/Not Applicable". Indicate your responses with a check mark (✓).

	Strongly Agree	Disagree	Neutral	Agree	Strongly Agree	Unable to Assess/Not Applicable
The reports prepared by this resident:						
1. accurate and concise						
2. grammatically clear						
3. timely						
4. answer the intended questions						
5. direct management appropriately						
6. suggest appropriate consultation						
7. discuss the limitations of the study						
8. offer a differential diagnosis, when appropriate						
The resident:						
9. performs urgent investigations promptly						
10. communicates urgent results promptly						
11. consults well with colleagues						
12. is available for consultation						
13. responds in a timely fashion when on call						
14. exhibits professional and ethical behavior towards medical colleagues						

NOTE: Form adapted from College of Physicians and Surgeons (Province of Alberta) Physician Achievement Review, Referring Physician Questionnaire

**TTUHSC-Paul L. Foster School of Medicine
Department of Radiology**

Medical Support Staff Survey

Resident: _____ PGYLevel: ____

Your name: _____ Position: _____

Instructions: The following statements describe physician behaviors. Indicate how much you agree with the statements listed using the scale categories provided as applied to the resident named on this form. If you feel an item is NOT relevant to you, mark the item, "Unable to Assess/Not Applicable". Indicate your responses with a check mark (√).

	Strongly Agree	Disagree	Neutral	Agree	Strongly Agree	Unable to Assess/Not Applicable
This resident:						
1. is punctual						
2. is approachable						
3. works efficiently						
4. introduces him/herself appropriately to patients						
5. helps patients understand what will occur during their procedure(s)						
6. listens to patients						
7. answers patient's questions appropriately						
8. demonstrates respect for patients regardless of gender, ethnicity or disability						
9. respects patient confidentiality						
10. treats me with respect						
11. demonstrates respect for medical support staff regardless of gender, ethnicity or disability						
12. demonstrates appropriate behavior in stressful situations						
13. works to resolve conflict in the workplace						
14. responds professionally and skillfully to urgent situations						
15. writes clearly						
16. speaks clearly and appropriately						

APPENDIX 2

Faculty Evaluation Form

**TTUHSC-Paul L. Foster School of Medicine
Department of Radiology**

Evaluation of Faculty by Residents

Rotation: _____ Dates of training: _____

Check (√) the name of the faculty member being evaluated:

- | | | | |
|---|---|--|---|
| <input type="checkbox"/> Noemi Brunner-Reynolds | <input type="checkbox"/> Jesus Calleros | <input type="checkbox"/> Michel-Alexis Courtines | <input type="checkbox"/> Jose Gavito |
| <input type="checkbox"/> Melhem Ghaleb | | | |
| <input type="checkbox"/> Hugo Isuani | <input type="checkbox"/> Sanja Kupesic | <input type="checkbox"/> Llewellyn Lee | <input type="checkbox"/> Lloyd Mark |
| <input type="checkbox"/> Albert Moreno | | | |
| <input type="checkbox"/> Anthony Naylor | <input type="checkbox"/> Norris Parks | <input type="checkbox"/> Branko Plavsic | <input type="checkbox"/> Luis Ramos-Duran |
| <input type="checkbox"/> Arvin Robinson | | | |
| <input type="checkbox"/> Jorge Sarmiento | <input type="checkbox"/> Henry Uhrig | <input type="checkbox"/> Jose Ulloa | <input type="checkbox"/> John Winston |

How much interaction did you have with the faculty member identified:

	Little interaction (less than 1 day per week)
	One to two days per week
	Three or more days per week
	Call exposure to faculty member only

Instructions: Please indicate your responses to the items listed below with a check mark (√) in the appropriate column. If an item is NOT relevant to the faculty member being evaluated mark the item “Unable to Assess/Not Applicable”.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Unable to Assess/Not Applicable
Provides clear expectations to guide my learning and performance						
Is available for personal instruction and consultation						
Is supportive of my efforts and provided meaningful feedback						
Effectively communicates during workstation instruction which helped facilitate my learning and skill development						
Is respectful at all times						
Serves as a role model in establishing good relationships with patients						
Serves as a role model in establishing collegial relationships with other physicians and other healthcare professionals						
Helps me to develop a personal learning plan to achieve education and training goals						
Assists me in developing/selecting topics for research and quality improvement projects						
Assists me in developing an appropriate research design and selecting appropriate statistical tests						
Assists me in conducting an appropriate and effective review of the literature						
Models oral presentation skills to facilitate my professional development in oral presentation						
Maintains a professional appearance						
Evaluates me fairly						
Provides an opportunity for me to remediate any identified deficiency						

APPENDIX 3

Program Evaluation Form

**Texas Tech HSC- Paul L. Foster School of Medicine
Department of Radiology
ANNUAL PROGRAM EVALUATION
RESIDENT QUESTIONNAIRE**

Check one: PGY-2 PGY-3 PGY-4 PGY-5

This questionnaire is a vital piece of the annual assessment of the residency program for program improvement.

Your responses are confidential. DO NOT PUT YOUR NAME ON THIS QUESTIONNAIRE. The questionnaire should take no more than 20 minutes to complete. Please feel free to provide comments in the section designated at the end of the questionnaire.

TRAINING:

1. Were you provided with a copy of the program's educational goals and objectives? Yes No

(Please note that this item does not refer to rotation goals and objectives)

Does your program prepare you to:	No	To a limited extent	To a moderate extent	To a great extent
2. perform thorough assessment of your patients				
3. develop treatment plans using clinical and scientific data and patient preferences				
4. use medical knowledge to think through medical problems				
5. stay current with up-to-date medical knowledge				
6. critically appraise evidence about treatment effectiveness				
7. implement a method to assess the effectiveness of your patient care activities				
8. collaborate and communicate effectively with patients and their families				
9. work effectively with other health care professionals				
10. apply professional and ethical principles to your practice of medicine				
11. respond sensitively to patients' culture, age, gender, and disabilities				
12. identify ways delivery systems affect care quality and patient safety				
13. use system resources to provide cost-conscious care				
14. develop and utilize a personal program of learning				

To what extent are the following types of learning experiences provided in your program:	Not at all	To a limited extent	To a moderate extent	To a great extent
15. Clinical teaching rounds				
16. Performance feedback				
17. Computer modules for self-directed learning				
18. High-tech simulations				
19. Role play or simulations				
20. Clinical conferences, lectures, seminars				
21. Scholarly activities, such as working on research for publication or presentation				
22. Use of standardized patients				
23. Use of anatomic or animal models				
24. Games				
25. Educational Conferences are:		////////	//////////	////////
pertinent to clinical medicine				
cite relevant research				
provide time for discussion				
are scheduled at convenient times				
are of high quality				

EVALUATION OF RESIDENT PERFORMANCE:

Respond to the following items by checking <i>Always, Sometimes or Never</i>	Always	Sometimes	Never
26. I have a formal evaluation session with the Program Director every six months of the training year AND receive a written evaluation			
27. I am familiar with the evaluation procedures in the training program and find that the system is:	////////	////////////////	////////
fair			
accurate			
consistent			
organized			
28. I receive sufficient informal performance feedback from the supervising faculty on each rotation			
29. The opportunity for remediation is available			
30. The process for resident discipline is clearly articulated			
31. Disciplinary actions are appropriate and consistent			
32. The process for resident complaint is clearly articulated			
33. Rotation performance evaluations are easily accessible to me			
34. My performance evaluations have been helpful in improving my performance and competence			
35. A variety of assessment methods are used to evaluate my performance			

WORK LOAD AND CALL SCHEDULE:

Respond to the following items by checking <i>Always, Sometimes or Never</i>	Always	Sometimes	Never
36. The workload averages no more than 80 hours/week over the rotation period (<i>includes hospital, clinics, home calls, approved internal moonlighting</i>)			
37. Consecutive work does not exceed 24 hours (<i>6 additional hours are permitted for non-patient care duties and are included in the 80-hour schedule</i>)			
38. There is at least a minimum of 10 consecutive hours for rest between on-duty assignments			
39. There is at least a minimum of one 24-hour non-working time per week, averaged over the rotation period (<i>free from all residency responsibilities including pager</i>)			
40. On-call assignment is not more frequent than every third night, averaged over the rotation period			

SUPERVISION:

Respond to each item by checking <i>Always, Sometimes or Never</i>	Always	Sometimes	Never
41. The residency program provides adequate and prompt supervision of residents			
42. The residency program educates (e.g., classes, rounds, discussions) its residents about the management of stress and fatigue			
43. A supervising physician is in the hospital 24 hrs/day			
44. I have adequate opportunity to learn required procedures for my specialty			
45. I am adequately supervised while learning required procedures			
46. The program provides the appropriate number of procedures to meet training requirements			
47. A remediation plan is developed to remedy any identified deficiencies			

WORK ENVIRONMENT AND ANCILLARY SERVICES:

Respond to the following items by checking <i>Always, Sometimes or Never</i> for the participating institutions in which you have rotated	Always	Sometimes	Never
48. On-call rooms are clean and secure			
49. Adequate security is provided for hospital grounds and clinics			
50. Food is available at all times			
51. Adequate library, computer access are available			
52. Medical records are accessible 24 hours/day			
53. There is sufficient professional, technical and clerical support personnel to support the residency program			
54. Adequate statistical consultation services are available			

EVALUATION OF PROGRAM FACULTY AND PROGRAM DIRECTOR:

Respond to the following items by checking <i>Always, Sometimes or Never</i>	Always	Sometimes	Never
55. Faculty teach and supervise in ways that facilitate my learning			
56. Faculty demonstrate a strong interest in the quality of the residents education			
57. Faculty engage in scholarly activities			
58. Faculty involve residents in scholarly activities			
59. Faculty are available for consultation at any time			
60. The Program Director:	////////	//////////	//////////
is decisive when addressing residents' concerns			
recognizes and resolves problems in a timely fashion			
is progressive in managing the residency program			
is easily approachable			
is reasonable in the demands placed on residents			

USE THE SPACE BELOW TO PROVIDE ANY COMMENTS YOU'D LIKE TO SHARE WITH THE INTERNAL REVIEW PANEL:

RESIDENT REQUIREMENTS FOR ADVANCEMENT

Resident Requirements for Advancement

Resident Promotion and Reappointment

Successful completion of all clinical rotations. Texas Tech University HSC adheres to the ACGME standards of the six areas of clinical competency. Residents must be deemed competent or show consistent improvement in all the six areas of competency as defined in the following pages by the Association of Program Directors in Radiology (APDR).

Resident attendance at conferences as defined in this manual.

On-call qualifying examination will be given each year. Residents are required to pass this examination prior to any overnight solo call assignments.

A score above the 10th percentile on the ACR in-service examination is required of all residents.

A score below will place the resident on **observation** and a makeup examination will be given in three months. If the resident does not pass this examination they will be on **probation**. If the examination is again not passed this will be grounds for dismissal.

Residents who pass the diagnostic written boards are exempt from this requirement.

Two cases per resident will be placed in the electronic teaching file annually. These cases will be used as part of the resident's portfolio. The cases should stress evidence-based medicine as defined by the clinical competencies. These cases are evaluated by the Education Committee.

Residents are expected to fill out monthly evaluations on the faculty involved with their instruction.

The department adheres to GME policies in regards to disability and sick time, but if that time is in excess of ten days per year, the committee will review the resident's activities to determine if additional days of training need to be added to that year before advancement to the next year or graduation from the program.

Disciplinary Actions

Standards, of academic performance and personal professional development, are the responsibility of the Program Director, Chairman and Education Committee. A resident experiencing difficulty with academic performance, impairment or professional misconduct may have disciplinary action taken in one of the following ways as outlined by the institution current Housestaff Policies and Procedures.

Remediation

Educational difficulties are sometimes experienced and at the direction of the Program Director and the Education Committee, a resident may be recommended to seek remedial assistance to provide a good academic experience within the department. Departmental mentorship is offered to trainees.

Moonlighting Policy

There is no provision for moonlighting during the residency. However, our residents are free to moonlight during full week vacations only subject to the following limitations:

Any extra work must **not** interfere with appropriate study or residency duties within the department.

Each resident engaging in professional activities outside the training program must ensure that the hours devoted to that activity are accounted for in the training program work hours.

These hours must be reported on the Office for Graduate Medical Education Work Hour Survey performed twice per year and also on any Chairman/Program Director work hour surveys.

The total hours must comply with the number of hours a trainee may work as outlined by ACGME guidelines and institution policy.

All moonlighting by residents, **must** be approved by the Chairman/ Program Director.

The resident must obtain written assurance of malpractice and workers' compensation coverage from any outside employer. The professional liability insurance provided by the University's insurance program covers only those activities that are required by the training program. There is no coverage for professional activities outside the scope of this residency program.

The residents must have a valid Texas State medical license and federal DEA number.

The moonlighting policies of the department are the same as those of the institution.

Those training with a J-1 visa are not eligible to moonlight.

Resident Supervision

The faculty is on-call in Diagnostic Radiology and Interventional Radiology. The faculty is on-site: Weekdays from 8:00 a.m. to 5:00 p.m., Saturdays and Sundays from 8:00 a.m. to 2:00 p.m. Faculty are also on duty with short call residents during the first twelve months of their training.

Faculty are present during all interventional procedures throughout training. There is a documented, supervised experience in interventional procedures as described by the ACGME Special Requirements for Core Residency Programs in Diagnostic Radiology. Data is entered into a database after each interventional procedure. A paper copy is given to each resident upon completion. Procedure documentation is also kept on file in the residency office for each resident during the entire residency training.

All studies preliminarily interpreted and/or performed by residents are promptly reviewed and edited by a faculty member before final reports are submitted. Any significant difference between preliminary and final reports is to be promptly called to the attention of the patient's physician.

Resident Teaching

After the first year, residents are encouraged to assume teaching responsibilities both for medical students and other residents. Any resident who has a special interest in teaching should make this known. Residents are involved in medical student teaching in all four years of medical school.

Sick Time

Residents are required to notify the residency coordinator of any absence due to sickness. If the resident is away for more than three consecutive days, a physician affirmation must be presented before returning to work. A resident is permitted a maximum of ten sick days a year. If this number is exceeded, the resident must extend the residency or use vacation days. Once notified of an unscheduled absence, the residency coordinator will notify the chief residents and current rotation section faculty in order to assure adequate coverage. Excessive use of sick time is serious cause for concern as it impacts patient care, resident education and workflow and does not conform to departmental standards for professionalism. The Department of Radiology adheres to GME policies in regards to disability and sick time, but if that disability or sick time is in excess of ten days per year, the residency committee will review the resident's activities and determine if additional days of training

need to be added to that year before advancement to the next year or graduation from the program. These determinations will be made and information will be relayed to the resident in a timely manner so that arrangements in the resident's personal schedule/commitments can be adjusted accordingly.

The Education Committee reserves the right to take action in excessive use of sick time and the resident might be required to undergo remedial action. ***Vacation days for the following year may not be used to make-up time lost.***

Leave of Absence

Should a resident need to request a Leave of Absence, discussion with the Program Director is the first step. The department adheres to the procedures as outlined by the institution in the current GME Policies and Procedures Manual.

Short Term Disability/ Maternity Leave

Those who need to apply for Short-Term Disability or maternity leave need to make arrangements with the Program Director and must adhere to University guidelines as outlined in the GME Policies and Procedures Manual.

Paternity Leave

Paternity leave is provided under the Family Medical Leave Act and allows for up to 12 weeks unpaid leave for the birth or adoption of a child. In order to qualify a minimum of 1,250 hours must be worked during the preceding year (12-month period).

It is the resident's responsibility to make his request directly to the Program Director well in advance in order to provide adequate coverage and make appropriate schedule and rotation adjustments, as well as filing the appropriate paperwork with the residency office.

Declared Pregnancy and Radiation Safety

A resident who is pregnant, for her safety and that of the child, must notify the Program Director as quickly as possible, in order to insure that proper safety measures are taken in conjunction with guidelines set by the hospital.

Reimbursement and Purchasing Guidelines

The residents are permitted a \$2,500 professional allowance designed to cover radiology professional expenses over the four years that they are in residency. Residents may only use their "professional account money" to purchase radiology books on the recommended reading list. (If they purchase them through the department, using a requisition, they save the sales tax). Residents may use the professional account money to pay for a radiology "review course" – registration, housing, airfare. Residents may **NOT** use the "professional account money" for any other expenses, including: computers, cameras, ABR fees, USMLE fees, etc. Any and all purchases and/or reimbursements must be approved in writing by the Program Director.

Books paid for by credit card or an outside vendor, provided there is an adequate balance, may be reimbursed with the understanding that the University does NOT reimburse for sales tax. The Radiology Accounting office and the Department Chair reserve the right to refuse reimbursement with adequate explanation. It is best to inquire prior to purchase.

Palm Pilots

NOTE: iPods **are not** an allowable expense from the book fund.

Travel and Conference

Residents are also entitled to reimbursement for allowable expenses where the resident is the first author for an oral presentation, scientific poster presentation or as an invited speaker at a national meeting with prior permission for abstract submission obtained from the program director.

The resident must submit a copy of the abstract along with the verification letter or email from the society.

Reimbursement up to \$1,500.00 and a total of four meeting days is allowed.

These are the allowable expenses, with appropriate receipts, for all meeting travel:

Airfare travel – requires airline receipt with original boarding passes. If the university has NOT paid for this travel in advance, then a credit card statement and/or bank statement is necessary for this claim.

Travel mileage if travel by personal vehicle

Hotel – requires hotel check-out statement, with statement showing payment.

Meals (excluding alcoholic beverages) with required receipts

These items are **not** allowed for reimbursement:

Expenses for spouse or person other than the resident attending the conference

Hotel expenses such as videos, spa, gym, gifts or alcoholic beverages.

Capital purchases in excess of \$1,000, including independent purchase of computer parts

Residency materials, i.e. textbooks, purchased prior to the start of residency training.

GENERAL COMPETENCIES IN RADIOLOGY TRAINING
DEFINITIONS, SKILLS, EDUCATION AND ASSESSMENT

Prepared by the Association of Program Directors in Radiology (APDR) Education
Committee, January 2002

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Introduction

The Accreditation Council for Graduate Medical Education (ACGME) Outcome Project is a long-term initiative by which the ACGME is increasing emphasis on educational outcomes in the accreditation of residency programs (<http://www.acgme.org>). The impetus for this project is based on a system of medical education that relies heavily on public funding and is therefore accountable to the public in terms of meeting public needs and preparing well-qualified new physicians in the most cost-effective way possible. The current model of accreditation focuses on the potential of a residency program to educate residents (i.e. whether the program complies with the requirements, has established objectives and an organized curriculum, and evaluates the residents and itself). However, measuring program quality by examining structure and process is not a direct or complete measure of the quality of the educational outcomes of a program. In the future, accreditation will focus on actual accomplishments of a program, through assessment of program outcomes (i.e. whether the residents achieve the learning objectives set by the program, whether the program provides evidence of this achievement, and whether the program demonstrates continuous improvement in its educational process). The ACGME Outcome Project Advisory Committee identified six general competencies that were subsequently endorsed by the ACGME in February 1999. They are patient care, medical knowledge, practice based-learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice. All Residency Review Committees (RRCs) must include minimum language regarding the general competencies and evaluation processes in their respective Program Requirements by July 2002. A major activity of the Outcome Project was the identification and development of measurement tools for programs to use as part of an overall evaluation system. The ACGME and the American Board of Medical Specialties (ABMS) collaborated on the development of a "Toolbox" (<http://www.acgme.org>) of assessment methods. The Toolbox (© Copyright 2000 Accreditation Council for Graduate Medical Education and American Board of Medical Specialties, Version 1.1, September 2000) includes descriptions of instruments recommended for use by programs as they assess the outcomes of their educational efforts. In addition to a description, the Toolbox includes information pertaining to the use, psychometric qualities, and feasibility/practicality of different assessment methods.

A radiology "quadrad", composed of representatives from the Radiology RRC (including a resident member of the RRC), the American Board of Radiology, and the Association of Program Directors in Radiology (APDR) was formed in the spring of 2000 to interpret the six competencies as they relate to radiology, and choose evaluation methods from the ACGME/ABMS Toolbox that are most appropriate for evaluating radiology resident competence. As an extension of the work done by the quadrad, the APDR Education Committee developed and

adopted the following descriptions of the six competencies, outlining for each the definition of the competency, resident skills and education related to the competency and assessment of resident competence

PATIENT CARE: Provide patient care that is compassionate, appropriate and effective.

Skills

- Gather essential and accurate information about patients
- Develop a diagnostic plan based upon the clinical question/s and relevant clinical, radiologic and pathologic information
- Oversee diagnostic imaging to ensure adequacy of studies performed
- Counsel patients concerning preparation for diagnostic testing
- Demonstrate a basic understanding of electronic patient information systems
- Demonstrate the ability to use the Internet as an educational instrument to expand medical knowledge
- Demonstrate knowledge of the levels of ionizing radiation related to specific imaging procedures and employ measures to minimize radiation dose to the patient
- Perform radiologic examinations appropriately and safely, assuring that the correct examination is ordered and performed

Education (with graduated faculty supervision and feedback)

- Practical experience in developing a differential diagnosis and management plan based upon clinical data, imaging findings and other medical test results
- Active participation in journal reviews to determine the effectiveness of diagnostic imaging for specific diagnostic questions
- Graduated responsibility in performing radiologic procedures
- Didactic instruction in radiation safety
- Preparation and presentation of radiologic cases to other members of the health care team

Assessment

- Global ratings by faculty
- 360 degree examination
- Procedure log
- Objective structured clinical examination

MEDICAL KNOWLEDGE: Residents must demonstrate knowledge about established and evolving biomedical and clinical sciences and the application of this knowledge to patient care.

Skills

- Demonstrate sufficient knowledge of medicine and apply this knowledge to radiological studies in a clinical context to generate meaningful differential diagnoses
- Demonstrate progressive acquisition of radiological knowledge
- Demonstrate knowledge of the principles of research design and implementation
- Generate a clinically appropriate diagnostic treatment plan
- Demonstrate the ability to use all relevant information resources to acquire evidence-based data
- Understand how radiologic equipment can be used to generate appropriate and diagnostic images

Education

- Didactic lectures and self-directed learning on the science and practice of radiology
- Participation in departmental and inter-departmental case conferences
- Participation in the clinical activities of the radiology department
- Departmental or institutional training programs on research design and implementation

Assessment

- Global ratings by faculty
- Program-developed written examinations
- ACR in-training examination
- Written ABR examination
- Oral ABR examination
- Raphex physics examination

INTERPERSONAL AND COMMUNICATION SKILLS: Residents must demonstrate interpersonal and communication skills that result in effective information exchange with patients, patient family members, medical students, other residents, supervising faculty, referring physicians, technologists, nurses and other members of the health care team.

Skills

- Provide a clear and informative written radiologic report including a precise diagnosis whenever possible, a differential diagnosis when appropriate, and recommended follow-up or additional studies when appropriate
- Provide direct communication to the referring physician or appropriate clinical personnel when interpretation reveals an urgent or unexpected finding and document this communication in the radiologic report
- Demonstrate effective skills of face-to-face listening and speaking with physicians, patients, patient's families and support personnel
- Demonstrate appropriate telephone communication skills
- Demonstrate skills in obtaining informed consent, including effective communication to patients of the procedure, alternatives and possible complications

Education (with graduated faculty supervision and feedback)

- Participation as an active member of the radiology team by communicating face-to-face with clinicians, answering the telephone, providing consults, problem solving and decision-making
- Act as the contact person for technologists and nurses in managing patient and imaging issues
- Active participation in preparing and moderating multi-disciplinary conferences
- Practical experience in dictating radiological reports

Assessment

- Global ratings by faculty
- 60° evaluations
- Oral ABR examination
- Record review (systematic evaluation of resident dictations)

PROFESSIONALISM: Demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population.

Skills

- Demonstrate altruism (putting the interests of patients and others above own self-interest)
- Demonstrate compassion: be understanding and respectful of the patients, patient families, and staff and physicians caring for patients
- Demonstrate excellence: perform responsibilities at the highest level and continue active learning throughout one's career
- Be honest with patients and all members of the health care team
- Demonstrate honor and integrity: avoid conflicts of interest when accepting gifts from patients or vendors
- Interact with others without discriminating on the basis of religious, ethnic, sexual or educational differences and without employing sexual or other types of harassment
- Demonstrate knowledge of issues of impairment (i.e. physical, mental and alcohol and substance abuse), obligations for impaired physician reporting, and resources and options for care of self impairment or impaired colleagues
- Demonstrate positive work habits, including punctuality and professional appearance
- Demonstrate an understanding of broad principles of biomedical ethics
- Demonstrate principles of confidentiality with all information transmitted during a patient encounter
- Demonstrate knowledge of regulatory issues pertaining to the use of human subjects in research

Education

- Discussion of conflicts of interest and the ethics of conducting research during departmental or institutional conferences and daily clinical work
- Training programs (i.e. videotapes) on the issues of harassment and discrimination.
- Didactic presentations on the recognition and management of the “impaired physician”
- Participation in hospital-sponsored core curriculum educational activities (i.e. lectures, web-based programs)
- Didactic lecture/training program on the broad principles of medical ethics
- Institutional web-based self-directed learning and assessment programs on human subjects research guidelines

Assessment

- Global ratings by faculty
- 360° evaluations
- Conference attendance logs
- Resident self-assessment
- Written ABR examination

PRACTICE BASED LEARNING AND IMPROVEMENT: Residents must be able to investigate and evaluate their patient care practices, and appraise and assimilate scientific evidence in order to improve their radiologic practices.

Skills

- Analyze practice experience and perform practice-based improvement in cognitive knowledge, observational skills, formulating a synthesis and impression, and procedural skills
- Demonstrate critical assessment of the scientific literature
- Demonstrate knowledge of and apply the principles of evidence-based medicine in practice
- Use multiple sources, including information technology to optimize life-long learning and support patient care decisions
- Facilitate the learning of students, peers and other health care professionals

Education

- Participate in critical assessment of the scientific literature through journal clubs, clinical conferences and independent learning
- Didactic lectures on the assessment of scientific literature, study designs and statistical methods
- Teaching students, peers and other health care professionals, with graduated supervision and feedback from supervising faculty
- Active participation in departmental or institutional quality assurance (QA)/quality improvement (QI) activities with faculty supervision

Assessment

- Global ratings by faculty
- ACR in-service examination
- Written ABR examination
- QA/QI conference attendance logs
- Global ratings by students
- Procedure log

SYSTEMS BASED PRACTICE: Demonstrate an awareness and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide optimal care.

Skills

- Demonstrate the ability to design cost-effective care plans based on knowledge of best practices
- Demonstrate knowledge of the sources of financing for U.S. health care including Medicare, Medicaid, the Veteran's Affairs and Department of Defense, public health systems, employer-based private health plans, and patient's own funds
- Demonstrate knowledge of basic health care reimbursement methods
- Demonstrate knowledge of the regulatory environment including state licensing authority, state and local public health rules and regulations, and regulatory agencies such as Centers for Medicaid and Medicare Services (CMS) and Joint Commission for the Accreditation of Healthcare Organizations (JCAHO)
- Demonstrate knowledge of basic practice management principles such as budgeting, record keeping, medical records, and the recruitment, hiring, supervision and management of staff

Education

- Systematic review of appropriate literature, including current American College of Radiology (ACR) Appropriateness Criteria, to develop knowledge of evidence based indications for imaging procedures
- Attendance and active participation in departmental and multi-disciplinary conferences where there is discussion of the imaging evaluation of specific diseases and most appropriate and cost-effective methods for establishing a diagnosis
- Interaction with department administrators and knowledgeable faculty to gain an understanding of the costs of diagnostic examinations and the influence of the type of payer system on reimbursement
- ACR/APDR non-interpretive skills videotapes
- Membership and active participation in local and national radiological societies
- Departmental or institutional presentations on health care funding and regulation

Assessment

- Global ratings by faculty
- Written ABR examination
- ACR in-training examination
- Multi-disciplinary conference attendance logs
- Documented membership and participation in radiologic societies and other health care organizations

Appendix. Descriptions of Selected Assessment Methods

360° evaluation. 360° evaluations consist of measurement tools completed by multiple people in a person's sphere of influence. Evaluators can include superiors, peers, subordinates, patients, and patient families. Most 360° evaluation processes use a survey or questionnaire to gather information about an individual's performance on several topics (e.g. teamwork, communication, management skills, decisionmaking), and use rating scales to assess how frequently a behavior is performed. Reproducible results are most easily obtained when five to ten nurses rate a resident, while a greater number of faculty and patients are needed for the same degree of reliability.

Global ratings. Global rating forms are distinguished from other rating forms in that a rater judges general categories of ability (e.g. patient care skills, medical knowledge, interpersonal and communication skills) instead of specific skills, tasks or behaviors. The ratings are completed retrospectively based on general impressions collected over a period of time (e.g. at the end of a clinical rotation) derived from multiple sources of information

(e.g. direct observations or interactions; input from other faculty, residents, or patients; review of work products or written materials). Typical rating scales consist of qualitative indicators and often include numeric values for each indicator. Written comments are important to allow evaluators to explain the ratings. Scores can be highly subjective when raters are not well trained. Sometimes all competencies are rated the same regardless of performance. Reproducibility is easier to achieve for ratings of knowledge and more difficult to achieve for patient care and interpersonal and communication skills.

Objective structured clinical examination (OSCE). In an objective structured clinical examination (OSCE), one or more assessment tools are administered at 12 to 20 separate stations, each station lasting ten-fifteen minutes. All candidates move from station to station in sequence on the same schedule. Radiologic OSCEs include image interpretation and procedural exercises. OSCEs are only cost-effective when many candidates are examined at one administration.

Procedure case logs. Procedure logs document each patient encounter by medical conditions seen, procedure performed, and complications. Regular review of logs can be used to help residents track what cases or procedures must be completed in order to meet residency requirements or specific learning objectives. Logs documenting experience for the entire residency can serve as a summative report of that experience, but the numbers do not necessarily indicate competence.

Record review. Trained persons (e.g. radiology faculty members) perform a review of patient records produced by the resident (e.g. dictations). A checklist of predefined criteria can be used to abstract information from the records. The record review can provide evidence about observational, synthesis, management and communication skills.

Standardized oral examination. The standardized oral examination is a type of performance assessment using realistic radiologic cases with a trained radiologist questioning the examinee. Resident skills in observation, synthesis and management can be assessed. Fifteen of the 24 American Board of Medical Specialties (ABMS) Member Boards use standardized oral examinations as the final examination for initial certification. “mock orals”, that use cases but with much less standardization compared to board oral examinations, are often used in residency training programs to help familiarize residents with the oral examinations conducted for board certification.

Standardized written examination. A written or computer-based examination is composed, usually, of multiple-choice questions (MCQ) to sample medical knowledge and understanding of a defined body of knowledge, not just factual or easily recalled information. The examination can include image interpretation items. Medical knowledge and understanding can be measured by MCQ examinations. Comparing the test scores on in-training examinations with national statistics can serve to identify strengths and limitations of individual residents to help them improve. Comparing test results aggregated for residents in each year of a program can be helpful to identify residency training experience that might be improved. All of the 24 ABMS Member Boards use MCQ examinations for initial certification.

ACGME GENERAL COMPETENCIES

PATIENT CARE

COMPETENCY DEFINITION

PRACTICE PERFORMANCE MEASUREMENTS

Provide patient care through safe, efficient, appropriately utilized, quality-controlled diagnostic and/or interventional radiology techniques and effectively communicate results to the referring physician and/or other appropriate individuals in a timely manner.

Global faculty evaluation (to include evaluation of knowledge about safety issues such as radiation dose, MRI safety, correct patient- exam-site verification, use of standard abbreviations)

Case/procedure logs (to be included in the resident learning portfolio)

OSCE (Objective Standardized Clinical Examination) or direct observation of selected procedures and other critical processes (such as obtaining informed consent)

360 degree evaluations

MEDICAL KNOWLEDGE

COMPETENCY DEFINITION

PRACTICE PERFORMANCE MEASUREMENTS

Engage in continuous learning using up to date evidence and apply appropriate state of the art diagnostic and/or interventional radiology techniques to meet the imaging needs of patients, referring physicians and the health care system

Global faculty evaluation (which includes the 6 competencies)

Yearly objective test (e.g., mock oral boards, ABR in-service test, ABR written examination)

Resident learning portfolio (including documentation of conferences attended, courses attended, self-assessment modules completed, etc.)

Journal club to evaluate skills in accessing, interpreting and applying best evidence in the radiology literature to patient care.

PRACTICE BASED LEARNING AND IMPROVEMENT

COMPETENCY DEFINITION

PRACTICE PERFORMANCE MEASUREMENTS

Participation in evaluation of one's personal practice utilizing scientific evidence, "best practices" and self-assessment programs in order to optimize patient care through lifelong learning.

Global faculty evaluation

Resident learning portfolio (to include utilization of self-assessment modules)

Documentation of participation in departmental QI/QA and regulatory activities

INTERPERSONAL AND COMMUNICATION SKILLS

COMPETENCY DEFINITION

PRACTICE PERFORMANCE MEASUREMENTS

Communicate effectively with patients, colleagues referring physicians and other members of the health care team concerning imaging appropriateness, informed consent, safety issues and results of imaging tests or procedures.

Global faculty evaluation

360 degree evaluations

Evaluation of quality of reports

OSCE or direct observation of communication issues (e.g., informed consent, speaking with patients about adverse events or outcomes of imaging tests, consultation with referring clinicians)

PROFESSIONALISM

COMPETENCY DEFINITION

PRACTICE PERFORMANCE MEASUREMENTS

Commit to high standards of professional conduct, demonstrating altruism, compassion, honesty and integrity. Follow principles of ethics and confidentiality and consider religious, ethnic, gender, educational and other differences in interacting with patients and other members of the health care team

Global faculty evaluation

360 degree evaluations

Verify status of medical license, if appropriate

Documentation of compliance with institutional and departmental policies (e.g., conference attendance, HIPPA, JCAHO, dress code)

SYSTEM-BASED PRACTICE

COMPETENCY DEFINITION PRACTICE PERFORMANCE MEASUREMENTS

Understand how the components of the local and national healthcare system function interdependently and how changes to improve the System, involve group and individual efforts. Optimize coordination of patient care both within one's own practice and within the healthcare system. Consult with other healthcare professionals, and educate healthcare consumers, regarding the most appropriate utilization of imaging resources.

- Global faculty evaluation

- Documentation of resident participation in analysis of systems-based problem

- Resident learning portfolio (to include documentation of active participation in multidisciplinary conferences)

Thursday, October 11, 2007